PREDICTED ENERGY ASSESSMENT

Design SAP
elmhurst energy

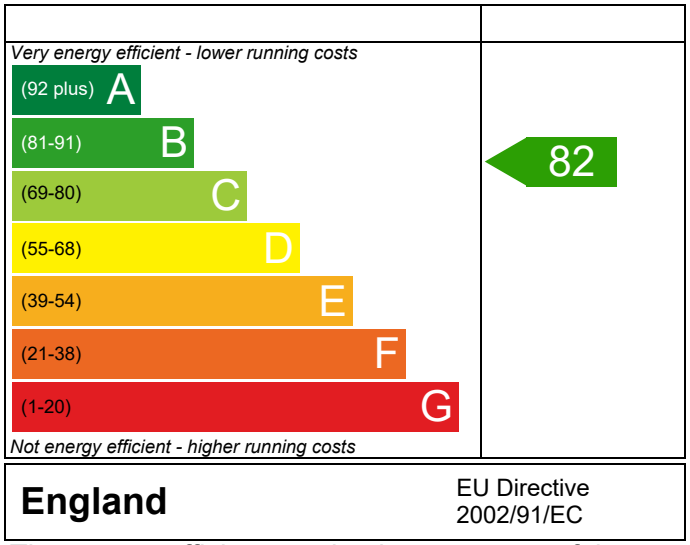
Southbourne,
PO10

Dwelling type:	Maisonette, Detached
Date of assessment:	16/11/2022
Produced by:	Gary Nicholls
Total floor area:	60.998 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.

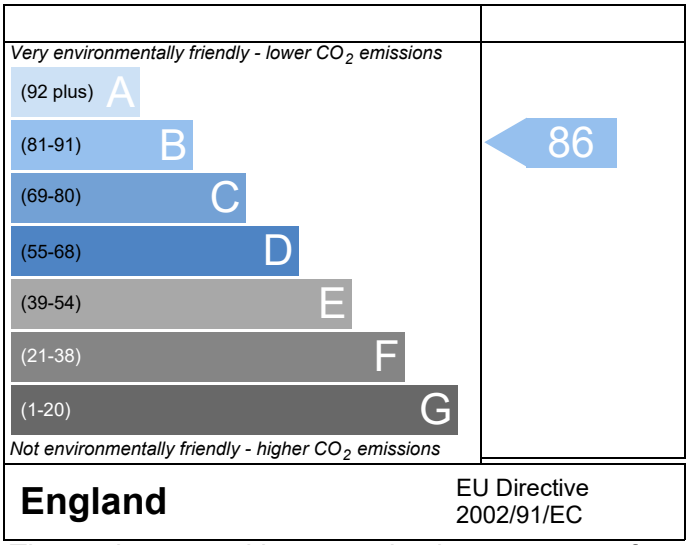
Energy Efficiency Rating



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	180 - PRJ012848	**Issued on Date**	16/11/2022
Assessment Reference	180	**Prop Type Ref**	2BF03 SAT GF 4.9
Property	Southbourne, PO10		

SAP Rating	82 B	**DER**	20.47	**TER**	20.61
Environmental	86 B	**% DER<TER**	0.66		
CO_2 Emissions (t/year)	0.99	**DFEE**	50.23	**TFEE**	55.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.28		

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

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DWELLING AS DESIGNED

Detached Maisonette, total floor area 61 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) 20.61 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.47 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.2 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	(no roof)		
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: 3.24 m², No overhang
Windows facing East: 1.26 m², No overhang
Windows facing West: 3.24 m², No overhang
Air change rate: 4.74 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
Thermal bridging y-value 0.039 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	60.9980 (1b)	x	2.3770 (2b)	=	144.9922	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9980					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.9922	(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) =	0.2069	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4574	(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) =	0.4574	(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	0.5832	0.5718	0.5603	0.5031	0.4917	0.4345	0.4345	0.4231	0.4574	0.4917	0.5146	0.5375	(22b)
Effective ac	0.6701	0.6635	0.6570	0.6266	0.6209	0.5944	0.5944	0.5895	0.6046	0.6209	0.6324	0.6444	(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)			7.7400	1.2357	9.5646			(27)
Flr - Ground			60.9980	0.1782	10.8704	75.6000	4611.4488	(28a)
Brick	69.4690	9.8420	59.6270	0.2700	16.0993	107.1000	6386.0517	(29a)
Total net area of external elements Aum(A, m2)			130.4650					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0543			(33)
Party Ceiling			60.9980			7.4000	451.3852	(32b)
Stud			80.8798			7.4000	598.5105	(32c)
Block			33.0403			54.0300	1785.1674	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13832.5636 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.7708 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.0334 (36)
Total fabric heat loss	(33) + (36) =	44.0877 (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	32.0606	31.7446	31.4349	29.9802	29.7080	28.4411	28.4411	28.2064	28.9291	29.7080	30.2586	30.8342	(38)
Heat transfer coeff	76.1483	75.8323	75.5226	74.0679	73.7958	72.5288	72.5288	72.2941	73.0168	73.7958	74.3463	74.9220	(39)
Average = Sum(39)m / 12 =												74.0666	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2484	1.2432	1.2381	1.2143	1.2098	1.1890	1.1890	1.1852	1.1970	1.2098	1.2188	1.2283	(40)
HLP (average)												1.2142	(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	2.0097 (42)
Average daily hot water use (litres/day)	81.9305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1236	86.8464	83.5691	80.2919	77.0147	73.7375	73.7375	77.0147	80.2919	83.5691	86.8464	90.1236	(44)
Energy conte	133.6507	116.8917	120.6218	105.1610	100.9045	87.0729	80.6858	92.5882	93.6940	109.1913	119.1909	129.4335	(45)
Energy content (annual)										Total = Sum(45)m =		1289.0864	(45)
Distribution loss (46)m = 0.15 x (45)m	20.0476	17.5338	18.0933	15.7742	15.1357	13.0609	12.1029	13.8882	14.0541	16.3787	17.8786	19.4150	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	(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	16.1290	14.5375	16.0464	15.4737	15.9495	15.3888	15.8730	15.9226	15.4351	16.0063	15.5539	16.1130	(61)
Total heat required for water heating calculated for each month													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(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													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(64)
								Total per year (kWh/year) = Sum(64)m =				1477.5150	(64)
Heat gains from water heating, kWh/month													
	48.4711	42.5009	44.1184	38.8345	37.5381	32.7989	30.7963	34.7662	35.0120	40.3077	43.5194	47.0649	(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	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.0418	15.1364	12.3097	9.3193	6.9663	5.8812	6.3549	8.2603	11.0869	14.0774	16.4304	17.5155	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4567	177.2774	172.6893	162.9218	150.5921	139.0040	131.2623	129.4417	134.0297	143.7972	156.1269	167.7151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	(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)													
	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	(71)
Water heating gains (Table 5)													
	65.1493	63.2454	59.2989	53.9368	50.4544	45.5541	41.3929	46.7288	48.6278	54.1770	60.4436	63.2593	(72)
Total internal gains													
	313.7935	311.8048	300.4435	282.3235	264.1584	246.5848	235.1557	240.5763	249.8901	268.1972	289.1466	304.6355	(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	3.2400	10.6334	0.7600	0.7200	0.7700	13.0646	(74)
East	1.2600	19.6403	0.7600	0.7200	0.7700	9.3842	(76)
West	3.2400	19.6403	0.7600	0.7200	0.7700	24.1308	(80)

Solar gains	46.5796	90.5296	150.3972	225.6165	284.7849	295.8290	279.8318	234.3513	176.5848	107.5155	57.9061	38.4524	(83)
Total gains	360.3731	402.3343	450.8408	507.9400	548.9434	542.4138	514.9874	474.9276	426.4749	375.7127	347.0527	343.0879	(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	50.4592	50.6694	50.8772	51.8764	52.0678	52.9773	52.9773	53.1492	52.6232	52.0678	51.6822	51.2851	
alpha	4.3639	4.3780	4.3918	4.4584	4.4712	4.5318	4.5318	4.5433	4.5082	4.4712	4.4455	4.4190	
util living area													
	0.9971	0.9948	0.9880	0.9639	0.8955	0.7503	0.5907	0.6519	0.8794	0.9786	0.9948	0.9977	(86)
MIT	19.5127	19.6608	19.9388	20.3328	20.6801	20.9056	20.9754	20.9622	20.7880	20.3434	19.8717	19.5003	(87)
Th 2	19.8815	19.8856	19.8896	19.9086	19.9122	19.9288	19.9288	19.9319	19.9224	19.9122	19.9050	19.8975	(88)
util rest of house													
	0.9962	0.9931	0.9838	0.9506	0.8552	0.6605	0.4606	0.5223	0.8172	0.9684	0.9928	0.9969	(89)
MIT 2	18.5325	18.6832	18.9624	19.3629	19.6879	19.8822	19.9218	19.9199	19.7962	19.3811	18.9090	18.5325	(90)
Living area fraction									fLA = Living area / (4) =			0.4454	(91)
MIT	18.9691	19.1187	19.3973	19.7949	20.1299	20.3381	20.3911	20.3841	20.2380	19.8097	19.3378	18.9636	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8191	18.9687	19.2473	19.6449	19.9799	20.1881	20.2411	20.2341	20.0880	19.6597	19.1878	18.8136	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9912	0.9807	0.9465	0.8581	0.6842	0.5004	0.5615	0.8285	0.9652	0.9910	0.9959	(94)
Useful gains	358.5452	398.8095	442.1305	480.7815	471.0607	371.1269	257.6894	266.6585	353.3291	362.6439	343.9341	341.6885	(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													
	1105.6035	1066.8601	962.7106	795.8516	611.0179	405.2948	264.0856	277.1851	437.2225	668.5672	898.6868	1094.8774	(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													
	555.8113	448.9299	387.3116	226.8505	104.1281	0.0000	0.0000	0.0000	0.0000	227.6069	399.4219	560.3726	(98)
Space heating												2910.4329	(98)
Space heating per m2											(98) / (4) =	47.7136	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3215.9479	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	555.8113	448.9299	387.3116	226.8505	104.1281	0.0000	0.0000	0.0000	0.0000	227.6069	399.4219	560.3726	(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)													
	614.1562	496.0552	427.9686	250.6635	115.0587	0.0000	0.0000	0.0000	0.0000	251.4994	441.3502	619.1962	(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													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8013	89.7549	89.6430	89.3628	88.7792	87.3000	87.3000	87.3000	87.3000	89.3379	89.6709	89.8212	(217)
Fuel for water heating, kWh/month													
	166.7901	146.4312	152.4584	134.9943	131.6231	117.3673	110.6057	124.2964	125.0046	140.1394	150.2659	162.0404	(219)
Water heating fuel used												1662.0170	(219)
Annual totals kWh/year													
Space heating fuel - main system												3215.9479	(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)												300.9639	(232)
Total delivered energy for all uses												5253.9289	(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	3215.9479	0.2160	694.6448	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1662.0170	0.2160	358.9957	(264)
Space and water heating			1053.6404	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	300.9639	0.5190	156.2003	(268)
Total CO2, kg/year			1248.7657	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.4700	(273)

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

DER		20.4700	ZC1
Total Floor Area	TFA	60.9980	
Assumed number of occupants	N	2.0097	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0451	ZC2
CO2 emissions from cooking, equation (L16)		2.7416	ZC3
Total CO2 emissions		40.2568	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		40.2568	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	60.9980 (1b)	x	2.3770 (2b)	=	144.9922	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9980					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.9922	(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							2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1379	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3879	(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) =	0.3879	(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	0.4946	0.4849	0.4752	0.4267	0.4170	0.3685	0.3685	0.3588	0.3879	0.4170	0.4364	0.4558	(22b)
Effective ac	0.6223	0.6176	0.6129	0.5911	0.5870	0.5679	0.5679	0.5644	0.5752	0.5870	0.5952	0.6039	(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)			7.7400	1.3258	10.2614			(27)
Flr - Ground			60.9980	0.1300	7.9297			(28a)
Brick	69.4690	9.8420	59.6270	0.1800	10.7329			(29a)
Total net area of external elements Aum(A, m2)			130.4650					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.0240			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2543	(36)
Total fabric heat loss					(33) + (36) =		40.2783	(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	29.7767	29.5494	29.3266	28.2802	28.0845	27.1731	27.1731	27.0043	27.5241	28.0845	28.4805	28.8946	(38)
Heat transfer coeff	70.0549	69.8277	69.6049	68.5585	68.3627	67.4514	67.4514	67.2826	67.8024	68.3627	68.7588	69.1728	(39)
Average = Sum(39)m / 12 =												68.5576	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1485	1.1448	1.1411	1.1239	1.1207	1.1058	1.1058	1.1030	1.1116	1.1207	1.1272	1.1340	(40)
HLP (average)												1.1239	(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	2.0097	(42)
Average daily hot water use (litres/day)	81.9305	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1236	86.8464	83.5691	80.2919	77.0147	73.7375	73.7375	77.0147	80.2919	83.5691	86.8464	90.1236	(44)
Energy conte	133.6507	116.8917	120.6218	105.1610	100.9045	87.0729	80.6858	92.5882	93.6940	109.1913	119.1909	129.4335	(45)
Energy content (annual)										Total = Sum(45)m =		1289.0864	(45)
Distribution loss (46)m = 0.15 x (45)m	20.0476	17.5338	18.0933	15.7742	15.1357	13.0609	12.1029	13.8882	14.0541	16.3787	17.8786	19.4150	(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	45.9260	39.9731	42.5859	39.5960	39.2458	36.3637	37.5758	39.2458	39.5960	42.5859	42.8283	45.9260	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	179.5767	156.8649	163.2077	144.7570	140.1503	123.4366	118.2617	131.8340	133.2900	151.7772	162.0192	175.3595	(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													
	179.5767	156.8649	163.2077	144.7570	140.1503	123.4366	118.2617	131.8340	133.2900	151.7772	162.0192	175.3595	(64)
								Total per year (kWh/year) = Sum(64)m =				1780.5349	(64)
Heat gains from water heating, kWh/month													
	55.9204	48.8598	50.7532	44.8650	43.3622	38.0427	36.2220	40.5970	41.0523	46.9526	50.3380	54.5182	(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	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.1486	15.2312	12.3868	9.3776	7.0099	5.9180	6.3947	8.3120	11.1564	14.1656	16.5333	17.6252	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4567	177.2774	172.6893	162.9218	150.5921	139.0040	131.2623	129.4417	134.0297	143.7972	156.1269	167.7151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	(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)													
	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	(71)
Water heating gains (Table 5)													
	75.1618	72.7080	68.2167	62.3126	58.2825	52.8370	48.6855	54.5659	57.0170	63.1083	69.9140	73.2771	(72)
Total internal gains													
	323.9126	321.3622	309.4385	290.7576	272.0302	253.9046	242.4881	248.4652	258.3487	277.2167	298.7198	314.7630	(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	3.2400	10.6334	0.6300	0.7000	0.7700	10.5290	(74)
East	1.2600	19.6403	0.6300	0.7000	0.7700	7.5629	(76)
West	3.2400	19.6403	0.6300	0.7000	0.7700	19.4475	(80)

Solar gains	37.5395	72.9597	121.2083	181.8291	229.5142	238.4148	225.5223	188.8687	142.3134	86.6490	46.6678	30.9896	(83)
Total gains	361.4521	394.3219	430.6468	472.5868	501.5443	492.3194	468.0104	437.3338	400.6621	363.8657	345.3876	345.7526	(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	60.4664	60.6632	60.8574	61.7862	61.9632	62.8004	62.8004	62.9579	62.4752	61.9632	61.6063	61.2375	
alpha	5.0311	5.0442	5.0572	5.1191	5.1309	5.1867	5.1867	5.1972	5.1650	5.1309	5.1071	5.0825	
util living area													
	0.9981	0.9967	0.9922	0.9751	0.9184	0.7787	0.6109	0.6688	0.8952	0.9840	0.9965	0.9985	(86)
MIT	19.7539	19.8731	20.1025	20.4295	20.7289	20.9250	20.9831	20.9736	20.8308	20.4537	20.0545	19.7386	(87)
Th 2	19.9614	19.9645	19.9674	19.9813	19.9839	19.9961	19.9961	19.9984	19.9914	19.9839	19.9787	19.9731	(88)
util rest of house													
	0.9975	0.9956	0.9893	0.9648	0.8832	0.6917	0.4832	0.5419	0.8365	0.9757	0.9950	0.9980	(89)
MIT 2	18.2999	18.4762	18.8124	19.2931	19.7043	19.9429	19.9895	19.9867	19.8454	19.3344	18.7516	18.2859	(90)
Living area fraction									fLA = Living area / (4) =			0.4454	(91)
MIT	18.9475	19.0984	19.3871	19.7993	20.1607	20.3803	20.4321	20.4263	20.2843	19.8330	19.3320	18.9330	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9475	19.0984	19.3871	19.7993	20.1607	20.3803	20.4321	20.4263	20.2843	19.8330	19.3320	18.9330	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9942	0.9871	0.9625	0.8903	0.7276	0.5406	0.5988	0.8562	0.9740	0.9937	0.9973	(94)
Useful gains	360.2207	392.0441	425.1057	454.8705	446.5169	358.2172	253.0173	261.8810	343.0607	354.4141	343.2169	344.8121	(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													
	1026.1301	991.4415	897.0021	747.2376	578.3943	389.8911	258.4787	270.8989	419.3112	631.1909	841.0541	1019.1243	(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													
	495.4366	402.7951	351.0910	210.5042	98.1167	0.0000	0.0000	0.0000	0.0000	205.9219	358.4428	501.6883	(98)
Space heating												2623.9966	(98)
Space heating per m2											(98) / (4) =	43.0177	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	2809.4182	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	495.4366	402.7951	351.0910	210.5042	98.1167	0.0000	0.0000	0.0000	0.0000	205.9219	358.4428	501.6883	(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)													
	530.4460	431.2581	375.9004	225.3793	105.0500	0.0000	0.0000	0.0000	0.0000	220.4732	383.7717	537.1395	(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													
	179.5767	156.8649	163.2077	144.7570	140.1503	123.4366	118.2617	131.8340	133.2900	151.7772	162.0192	175.3595	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4730	87.3216	86.9302	85.9928	84.1726	80.3000	80.3000	80.3000	80.3000	85.8198	86.9938	87.5479	(217)
Fuel for water heating, kWh/month													
	205.2938	179.6404	187.7457	168.3362	166.5035	153.7193	147.2748	164.1769	165.9900	176.8557	186.2423	200.3012	(219)
Water heating fuel used												2102.0797	(219)
Annual totals kWh/year													
Space heating fuel - main system												2809.4182	(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)												302.8489	(232)
Total delivered energy for all uses												5289.3468	(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	2809.4182	0.2160	606.8343	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2102.0797	0.2160	454.0492	(264)
Space and water heating			1060.8835	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	302.8489	0.5190	157.1786	(268)
Total CO2, kg/m2/year			1256.9871	(272)
Emissions per m2 for space and water heating			17.3921	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5768	(272b)
Emissions per m2 for pumps and fans			0.6381	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.3921 * 1.00) + 2.5768 + 0.6381, rounded to 2 d.p.			20.6100	(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	60.9980 (1b)	x	2.3770 (2b)	=	144.9922	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9980					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.9922	(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							2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1379	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3884	(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) =	0.3884	(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	0.4953	0.4855	0.4758	0.4273	0.4176	0.3690	0.3690	0.3593	0.3884	0.4176	0.4370	0.4564	(22b)
Effective ac	0.6226	0.6179	0.6132	0.5913	0.5872	0.5681	0.5681	0.5646	0.5754	0.5872	0.5955	0.6042	(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)			7.7400	1.2357	9.5646			(27)
Flr - Ground			60.9980	0.1782	10.8704	75.6000	4611.4488	(28a)
Brick	69.4690	9.8420	59.6270	0.2700	16.0993	107.1000	6386.0517	(29a)
Total net area of external elements Aum(A, m2)			130.4650					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0543			(33)
Party Ceiling			60.9980			7.4000	451.3852	(32b)
Stud			80.8798			7.4000	598.5105	(32c)
Block			33.0403			54.0300	1785.1674	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13832.5636 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.7708 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.0334 (36)
Total fabric heat loss	(33) + (36) =	44.0877 (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	29.7918	29.5639	29.3406	28.2915	28.0952	27.1815	27.1815	27.0123	27.5334	28.0952	28.4923	28.9074	(38)
Heat transfer coeff	73.8795	73.6516	73.4283	72.3792	72.1829	71.2692	71.2692	71.1000	71.6211	72.1829	72.5800	72.9951	(39)
Average = Sum(39)m / 12 =												72.3782	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2112	1.2074	1.2038	1.1866	1.1834	1.1684	1.1684	1.1656	1.1742	1.1834	1.1899	1.1967	(40)
HLP (average)												1.1866	(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	2.0097 (42)
Average daily hot water use (litres/day)	81.9305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1236	86.8464	83.5691	80.2919	77.0147	73.7375	73.7375	77.0147	80.2919	83.5691	86.8464	90.1236	(44)
Energy conte	133.6507	116.8917	120.6218	105.1610	100.9045	87.0729	80.6858	92.5882	93.6940	109.1913	119.1909	129.4335	(45)
Energy content (annual)										Total = Sum(45)m =		1289.0864	(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													

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	(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													
	28.4008	24.8395	25.6321	22.3467	21.4422	18.5030	17.1457	19.6750	19.9100	23.2032	25.3281	27.5046	(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	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.0418	15.1364	12.3097	9.3193	6.9663	5.8812	6.3549	8.2603	11.0869	14.0774	16.4304	17.5155	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4567	177.2774	172.6893	162.9218	150.5921	139.0040	131.2623	129.4417	134.0297	143.7972	156.1269	167.7151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	(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)													
	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	(71)
Water heating gains (Table 5)													
	38.1731	36.9635	34.4518	31.0371	28.8202	25.6986	23.0454	26.4449	27.6527	31.1870	35.1779	36.9686	(72)
Total internal gains													
	283.8172	282.5229	272.5965	256.4238	239.5242	223.7294	213.8082	217.2924	225.9150	242.2073	260.8808	275.3448	(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	3.2400	10.6334	0.7600	0.7200	0.7700	13.0646	(74)
East	1.2600	19.6403	0.7600	0.7200	0.7700	9.3842	(76)
West	3.2400	19.6403	0.7600	0.7200	0.7700	24.1308	(80)

Solar gains	46.5796	90.5296	150.3972	225.6165	284.7849	295.8290	279.8318	234.3513	176.5848	107.5155	57.9061	38.4524	(83)
Total gains	330.3968	373.0525	422.9937	482.0404	524.3091	519.5584	493.6399	451.6437	402.4998	349.7227	318.7869	313.7972	(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	52.0087	52.1697	52.3283	53.0868	53.2311	53.9136	53.9136	54.0419	53.6487	53.2311	52.9399	52.6389	
alpha	4.4672	4.4780	4.4886	4.5391	4.5487	4.5942	4.5942	4.6028	4.5766	4.5487	4.5293	4.5093	
util living area													
	0.9980	0.9961	0.9904	0.9690	0.9047	0.7640	0.6040	0.6701	0.8936	0.9832	0.9963	0.9984	(86)
MIT	19.5156	19.6622	19.9381	20.3257	20.6748	20.9020	20.9744	20.9595	20.7775	20.3283	19.8603	19.4966	(87)
Th 2	19.9111	19.9141	19.9170	19.9307	19.9333	19.9454	19.9454	19.9476	19.9407	19.9333	19.9281	19.9227	(88)
util rest of house													
	0.9973	0.9949	0.9870	0.9573	0.8671	0.6762	0.4740	0.5409	0.8361	0.9750	0.9949	0.9979	(89)
MIT 2	18.5584	18.7069	18.9835	19.3748	19.7027	19.8963	19.9380	19.9345	19.8055	19.3840	18.9159	18.5485	(90)
Living area fraction									fLA = Living area / (4) =			0.4454	(91)
MIT	18.9847	19.1324	19.4087	19.7984	20.1357	20.3443	20.3997	20.3911	20.2385	19.8046	19.3365	18.9708	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9847	19.1324	19.4087	19.7984	20.1357	20.3443	20.3997	20.3911	20.2385	19.8046	19.3365	18.9708	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9937	0.9850	0.9555	0.8752	0.7120	0.5323	0.5986	0.8549	0.9737	0.9938	0.9973	(94)
Useful gains	329.2611	370.6919	416.6549	460.5918	458.9001	369.9451	262.7719	270.3514	344.0958	340.5209	316.8078	312.9449	(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													
	1084.8996	1048.2380	947.8653	788.8147	608.9141	409.3883	270.7997	283.7643	439.6430	664.4178	888.1274	1078.1968	(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													
	562.1950	455.3110	395.2205	236.3205	111.6104	0.0000	0.0000	0.0000	0.0000	240.9793	411.3501	569.3474	(98)
Space heating												2982.3343	(98)
Space heating per m2											(98) / (4) =	48.8923	(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	669.9305	527.3921	540.3599	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8290	0.8958	0.8637	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	555.3928	472.4434	466.7080	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	682.9064	651.1846	603.4713	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													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	91.8099	132.9835	101.7519	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												326.5452 (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	22.9525	33.2459	25.4380	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												81.6363 (107)
Space cooling per m2												1.3383 (108)
Energy for space heating												48.8923 (99)
Energy for space cooling												1.3383 (108)
Total												50.2307 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.2 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.9980 (1b)	x	2.3770 (2b)	=	144.9922	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9980					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.9922	(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							2 * 10 =	20.0000	(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) =	20.0000	/ (5) =	0.1379	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3879	(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) =		0.3879	(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	0.4946	0.4849	0.4752	0.4267	0.4170	0.3685	0.3685	0.3588	0.3879	0.4170	0.4364	0.4558	(22b)
Effective ac	0.6223	0.6176	0.6129	0.5911	0.5870	0.5679	0.5679	0.5644	0.5752	0.5870	0.5952	0.6039	(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)			7.7400	1.3258	10.2614			(27)
Flr - Ground			60.9980	0.1300	7.9297			(28a)
Brick	69.4690	9.8420	59.6270	0.1800	10.7329			(29a)
Total net area of external elements Aum(A, m2)			130.4650					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0240			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2543	(36)
Total fabric heat loss					(33) + (36) =		40.2783	(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	29.7767	29.5494	29.3266	28.2802	28.0845	27.1731	27.1731	27.0043	27.5241	28.0845	28.4805	28.8946	(38)
Heat transfer coeff	70.0549	69.8277	69.6049	68.5585	68.3627	67.4514	67.4514	67.2826	67.8024	68.3627	68.7588	69.1728	(39)
Average = Sum(39)m / 12 =												68.5576	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1485	1.1448	1.1411	1.1239	1.1207	1.1058	1.1058	1.1030	1.1116	1.1207	1.1272	1.1340	(40)
HLP (average)												1.1239	(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		2.0097 (42)
Average daily hot water use (litres/day)		81.9305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1236	86.8464	83.5691	80.2919	77.0147	73.7375	73.7375	77.0147	80.2919	83.5691	86.8464	90.1236	(44)
Energy conte	133.6507	116.8917	120.6218	105.1610	100.9045	87.0729	80.6858	92.5882	93.6940	109.1913	119.1909	129.4335	(45)
Energy content (annual)										Total = Sum(45)m =		1289.0864	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	28.4008	24.8395	25.6321	22.3467	21.4422	18.5030	17.1457	19.6750	19.9100	23.2032	25.3281	27.5046 (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	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	100.4853	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	17.1486	15.2312	12.3868	9.3776	7.0099	5.9180	6.3947	8.3120	11.1564	14.1656	16.5333	17.6252	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	175.4567	177.2774	172.6893	162.9218	150.5921	139.0040	131.2623	129.4417	134.0297	143.7972	156.1269	167.7151	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	33.0485	(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)

	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	(71)

Water heating gains (Table 5)

	38.1731	36.9635	34.4518	31.0371	28.8202	25.6986	23.0454	26.4449	27.6527	31.1870	35.1779	36.9686	(72)

Total internal gains

	283.9240	282.6177	272.6736	256.4822	239.5678	223.7662	213.8480	217.3442	225.9845	242.2954	260.9837	275.4545	(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	3.2400	10.6334	0.6300	0.7000	0.7700	10.5290	(74)
East	1.2600	19.6403	0.6300	0.7000	0.7700	7.5629	(76)
West	3.2400	19.6403	0.6300	0.7000	0.7700	19.4475	(80)

Solar gains	37.5395	72.9597	121.2083	181.8291	229.5142	238.4148	225.5223	188.8687	142.3134	86.6490	46.6678	30.9896	(83)
Total gains	321.4634	355.5774	393.8819	438.3113	469.0820	462.1810	439.3703	406.2128	368.2979	328.9444	307.6515	306.4441	(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	60.4664	60.6632	60.8574	61.7862	61.9632	62.8004	62.8004	62.9579	62.4752	61.9632	61.6063	61.2375	
alpha	5.0311	5.0442	5.0572	5.1191	5.1309	5.1867	5.1867	5.1972	5.1650	5.1309	5.1071	5.0825	
util living area	0.9989	0.9979	0.9948	0.9816	0.9348	0.8085	0.6441	0.7077	0.9198	0.9896	0.9979	0.9992	(86)
MIT	19.6928	19.8143	20.0478	20.3823	20.6946	20.9099	20.9786	20.9658	20.7999	20.4034	19.9970	19.6783	(87)
Th 2	19.9614	19.9645	19.9674	19.9813	19.9839	19.9961	19.9961	19.9984	19.9914	19.9839	19.9787	19.9731	(88)
util rest of house	0.9985	0.9972	0.9927	0.9738	0.9046	0.7247	0.5127	0.5790	0.8698	0.9839	0.9970	0.9989	(89)
MIT 2	18.7661	18.8898	19.1248	19.4663	19.7642	19.9510	19.9902	19.9876	19.8688	19.4919	19.0838	18.7610	(90)
Living area fraction									fLA = Living area / (4) =			0.4454	(91)
MIT	19.1788	19.3016	19.5359	19.8743	20.1786	20.3782	20.4304	20.4233	20.2835	19.8979	19.4906	19.1696	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1788	19.3016	19.5359	19.8743	20.1786	20.3782	20.4304	20.4233	20.2835	19.8979	19.4906	19.1696	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9966	0.9916	0.9727	0.9114	0.7595	0.5720	0.6371	0.8869	0.9833	0.9965	0.9986	(94)
Useful gains	320.8649	354.3619	390.5850	426.3613	427.5156	351.0264	251.3270	258.7808	326.6363	323.4429	306.5671	306.0008	(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	1042.3366	1005.6284	907.3641	752.3825	579.6226	389.7444	258.3685	270.6998	419.2562	635.6297	851.9613	1035.4909	(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	536.7749	437.6511	384.4836	234.7353	113.1677	0.0000	0.0000	0.0000	0.0000	232.2670	392.6838	542.7406	(98)
Space heating												2874.5040	(98)
Space heating per m2											(98) / (4) =	47.1246	(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	634.0430	499.1402	511.3478	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8259	0.8985	0.8679	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	523.6845	448.4727	443.7834	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	615.8911	587.8055	550.4391	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	66.3887	103.6636	79.3518	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												249.4042	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

Intermittency factor (Table 10b)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	16.5972	25.9159	19.8380	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												62.3510 (107)
Space cooling per m2												1.0222 (108)
Energy for space heating												47.1246 (99)
Energy for space cooling												1.0222 (108)
Total												48.1467 (109)
Target Fabric Energy Efficiency (TFEE)												55.4 (109)

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	60.9980 (1b)	x	2.3770 (2b)	=	144.9922	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9980					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.9922	(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) =	0.2069	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4574	(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) =	0.4574	(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	0.5260	0.4803	0.4688	0.4574	0.4803	0.4231	0.4460	0.4231	0.4231	0.4574	0.4460	0.4688	(22b)
Effective ac	0.6383	0.6153	0.6099	0.6046	0.6153	0.5895	0.5994	0.5895	0.5895	0.6046	0.5994	0.6099	(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)			7.7400	1.2357	9.5646			(27)
Flr - Ground			60.9980	0.1782	10.8704	75.6000	4611.4488	(28a)
Brick	69.4690	9.8420	59.6270	0.2700	16.0993	107.1000	6386.0517	(29a)
Total net area of external elements Aum(A, m2)			130.4650					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0543			(33)
Party Ceiling			60.9980			7.4000	451.3852	(32b)
Stud			80.8798			7.4000	598.5105	(32c)
Block			33.0403			54.0300	1785.1674	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13832.5636 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.7708 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.0334 (36)
Total fabric heat loss	(33) + (36) =	44.0877 (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	30.5433	29.4421	29.1825	28.9291	29.4421	28.2064	28.6819	28.2064	28.2064	28.9291	28.6819	29.1825	(38)
Heat transfer coeff	74.6310	73.5298	73.2702	73.0168	73.5298	72.2941	72.7697	72.2941	72.2941	73.0168	72.7697	73.2702	(39)
Average = Sum(39)m / 12 =												73.0572	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2235	1.2054	1.2012	1.1970	1.2054	1.1852	1.1930	1.1852	1.1852	1.1970	1.1930	1.2012	(40)
HLP (average)												1.1977	(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	2.0097 (42)
Average daily hot water use (litres/day)	81.9305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1236	86.8464	83.5691	80.2919	77.0147	73.7375	73.7375	77.0147	80.2919	83.5691	86.8464	90.1236	(44)
Energy conte	133.6507	116.8917	120.6218	105.1610	100.9045	87.0729	80.6858	92.5882	93.6940	109.1913	119.1909	129.4335	(45)
Energy content (annual)										Total = Sum(45)m =		1289.0864	(45)
Distribution loss (46)m = 0.15 x (45)m	20.0476	17.5338	18.0933	15.7742	15.1357	13.0609	12.1029	13.8882	14.0541	16.3787	17.8786	19.4150	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF HEAT DEMAND 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	(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	16.1290	14.5375	16.0464	15.4737	15.9495	15.3888	15.8730	15.9226	15.4351	16.0063	15.5539	16.1130	(61)
Total heat required for water heating calculated for each month													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(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													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(64)
								Total per year (kWh/year) = Sum(64)m =				1477.5150	(64)
RHI water heating demand												1478	(64)
Heat gains from water heating, kWh/month													
	48.4711	42.5009	44.1184	38.8345	37.5381	32.7989	30.7963	34.7662	35.0120	40.3077	43.5194	47.0649	(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	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	42.6046	37.8410	30.7744	23.2982	17.4157	14.7030	15.8871	20.6507	27.7173	35.1935	41.0760	43.7887	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	261.8757	264.5931	257.7453	243.1669	224.7644	207.4686	195.9139	193.1965	200.0444	214.6227	233.0253	250.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	(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)													
	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	(71)
Water heating gains (Table 5)													
	65.1493	63.2454	59.2989	53.9368	50.4544	45.5541	41.3929	46.7288	48.6278	54.1770	60.4436	63.2593	(72)
Total internal gains													
	461.8917	457.9416	440.0806	412.6639	384.8966	359.9878	345.4560	352.8381	368.6516	396.2553	426.8070	449.6311	(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	3.2400	14.6401	0.7600	0.7200	0.7700	17.9874	(74)
East	1.2600	27.3735	0.7600	0.7200	0.7700	13.0792	(76)
West	3.2400	27.3735	0.7600	0.7200	0.7700	33.6321	(80)

Solar gains	64.6986	103.5920	171.7964	263.2558	319.7505	354.7057	335.6629	282.5290	214.5111	131.3719	77.1758	51.7629	(83)
Total gains	526.5903	561.5336	611.8770	675.9197	704.6471	714.6935	681.1189	635.3671	583.1627	527.6273	503.9828	501.3940	(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	51.4850	52.2560	52.4412	52.6232	52.2560	53.1492	52.8019	53.1492	53.1492	52.6232	52.8019	52.4412	
alpha	4.4323	4.4837	4.4961	4.5082	4.4837	4.5433	4.5201	4.5433	4.5433	4.5082	4.5201	4.4961	
util living area													
	0.9839	0.9773	0.9538	0.8841	0.7371	0.5121	0.3505	0.3617	0.6565	0.8956	0.9687	0.9857	(86)
MIT	19.9294	20.0528	20.3207	20.6495	20.8869	20.9837	20.9977	20.9975	20.9518	20.6960	20.2936	19.9447	(87)
Th 2	19.9012	19.9156	19.9190	19.9224	19.9156	19.9319	19.9256	19.9319	19.9319	19.9224	19.9256	19.9190	(88)
util rest of house													
	0.9790	0.9705	0.9395	0.8494	0.6658	0.4133	0.2375	0.2423	0.5536	0.8540	0.9575	0.9813	(89)
MIT 2	18.9607	19.0932	19.3558	19.6627	19.8509	19.9264	19.9253	19.9316	19.9120	19.7118	19.3388	18.9904	(90)
Living area fraction									fLA = Living area / (4) =			0.4454	(91)
MIT	19.3922	19.5206	19.7856	20.1023	20.3124	20.3973	20.4030	20.4064	20.3752	20.1502	19.7641	19.4155	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2422	19.3706	19.6356	19.9523	20.1624	20.2473	20.2530	20.2564	20.2252	20.0002	19.6141	19.2655	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9753	0.9662	0.9350	0.8505	0.6832	0.4432	0.2722	0.2789	0.5835	0.8575	0.9534	0.9778	(94)
Useful gains	513.5581	542.5425	572.1291	574.8535	481.4314	316.7642	185.3983	177.1900	340.2975	452.4287	480.5206	490.2682	(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													
	1040.5200	1005.2001	896.5031	733.9845	526.6484	321.5147	185.7790	177.5809	356.0600	584.1487	816.0457	1008.5973	(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													
	392.0596	310.9059	241.3342	114.5743	33.6414	0.0000	0.0000	0.0000	0.0000	97.9997	241.5780	385.6369	(98)
Space heating												1817.7301	(98)
RHI space heating demand												1818	(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	60.9980 (1b)	x	2.3770 (2b)	=	144.9922	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9980					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.9922	(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) =	0.2069	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4574	(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) =	0.4574	(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	0.5832	0.5718	0.5603	0.5031	0.4917	0.4345	0.4345	0.4231	0.4574	0.4917	0.5146	0.5375	(22b)
Effective ac	0.6701	0.6635	0.6570	0.6266	0.6209	0.5944	0.5944	0.5895	0.6046	0.6209	0.6324	0.6444	(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)			7.7400	1.2357	9.5646			(27)
Flr - Ground			60.9980	0.1782	10.8704	75.6000	4611.4488	(28a)
Brick	69.4690	9.8420	59.6270	0.2700	16.0993	107.1000	6386.0517	(29a)
Total net area of external elements Aum(A, m2)			130.4650					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0543			(33)
Party Ceiling			60.9980			7.4000	451.3852	(32b)
Stud			80.8798			7.4000	598.5105	(32c)
Block			33.0403			54.0300	1785.1674	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13832.5636 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.7708 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.0334 (36)
Total fabric heat loss	(33) + (36) =	44.0877 (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	32.0606	31.7446	31.4349	29.9802	29.7080	28.4411	28.4411	28.2064	28.9291	29.7080	30.2586	30.8342	(38)
Heat transfer coeff	76.1483	75.8323	75.5226	74.0679	73.7958	72.5288	72.5288	72.2941	73.0168	73.7958	74.3463	74.9220	(39)
Average = Sum(39)m / 12 =												74.0666	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2484	1.2432	1.2381	1.2143	1.2098	1.1890	1.1890	1.1852	1.1970	1.2098	1.2188	1.2283	(40)
HLP (average)												1.2142	(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	2.0097 (42)
Average daily hot water use (litres/day)	81.9305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1236	86.8464	83.5691	80.2919	77.0147	73.7375	73.7375	77.0147	80.2919	83.5691	86.8464	90.1236	(44)
Energy conte	133.6507	116.8917	120.6218	105.1610	100.9045	87.0729	80.6858	92.5882	93.6940	109.1913	119.1909	129.4335	(45)
Energy content (annual)										Total = Sum(45)m =		1289.0864	(45)
Distribution loss (46)m = 0.15 x (45)m	20.0476	17.5338	18.0933	15.7742	15.1357	13.0609	12.1029	13.8882	14.0541	16.3787	17.8786	19.4150	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF ENERGY RATINGS 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	(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	16.1290	14.5375	16.0464	15.4737	15.9495	15.3888	15.8730	15.9226	15.4351	16.0063	15.5539	16.1130	(61)
Total heat required for water heating calculated for each month													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(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													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(64)
								Total per year (kWh/year) = Sum(64)m =				1477.5150	(64)
Heat gains from water heating, kWh/month													
	48.4711	42.5009	44.1184	38.8345	37.5381	32.7989	30.7963	34.7662	35.0120	40.3077	43.5194	47.0649	(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	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	42.6046	37.8410	30.7744	23.2982	17.4157	14.7030	15.8871	20.6507	27.7173	35.1935	41.0760	43.7887	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	261.8757	264.5931	257.7453	243.1669	224.7644	207.4686	195.9139	193.1965	200.0444	214.6227	233.0253	250.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	(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)													
	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	(71)
Water heating gains (Table 5)													
	65.1493	63.2454	59.2989	53.9368	50.4544	45.5541	41.3929	46.7288	48.6278	54.1770	60.4436	63.2593	(72)
Total internal gains													
	461.8917	457.9416	440.0806	412.6639	384.8966	359.9878	345.4560	352.8381	368.6516	396.2553	426.8070	449.6311	(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	3.2400	10.6334	0.7600	0.7200	0.7700	13.0646	(74)
East	1.2600	19.6403	0.7600	0.7200	0.7700	9.3842	(76)
West	3.2400	19.6403	0.7600	0.7200	0.7700	24.1308	(80)

Solar gains	46.5796	90.5296	150.3972	225.6165	284.7849	295.8290	279.8318	234.3513	176.5848	107.5155	57.9061	38.4524	(83)
Total gains	508.4713	548.4712	590.4778	638.2805	669.6815	655.8168	625.2878	587.1894	545.2364	503.7708	484.7132	488.0835	(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	50.4592	50.6694	50.8772	51.8764	52.0678	52.9773	52.9773	53.1492	52.6232	52.0678	51.6822	51.2851	
alpha	4.3639	4.3780	4.3918	4.4584	4.4712	4.5318	4.5318	4.5433	4.5082	4.4712	4.4455	4.4190	
util living area													
	0.9889	0.9832	0.9683	0.9248	0.8271	0.6571	0.4982	0.5470	0.7847	0.9419	0.9814	0.9906	(86)
MIT	19.7467	19.8877	20.1452	20.4980	20.7825	20.9452	20.9875	20.9812	20.8749	20.5188	20.0856	19.7314	(87)
Th 2	19.8815	19.8856	19.8896	19.9086	19.9122	19.9288	19.9288	19.9319	19.9224	19.9122	19.9050	19.8975	(88)
util rest of house													
	0.9857	0.9783	0.9585	0.9011	0.7742	0.5660	0.3829	0.4292	0.7047	0.9185	0.9749	0.9879	(89)
MIT 2	18.7643	18.9068	19.1624	19.5144	19.7684	19.9036	19.9255	19.9264	19.8551	19.5435	19.1189	18.7618	(90)
Living area fraction									fLA = Living area / (4) =			0.4454	(91)
MIT	19.2019	19.3437	19.6002	19.9525	20.2201	20.3675	20.3985	20.3962	20.3093	19.9779	19.5495	19.1937	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0519	19.1937	19.4502	19.8025	20.0701	20.2175	20.2485	20.2462	20.1593	19.8279	19.3995	19.0437	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9825	0.9743	0.9538	0.8984	0.7827	0.5919	0.4182	0.4651	0.7242	0.9163	0.9711	0.9851	(94)
Useful gains	499.5892	534.3795	563.1695	573.4448	524.1845	388.2057	261.4969	273.0773	394.8569	461.6000	470.7178	480.8040	(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													
	1123.3294	1083.9227	978.0292	807.5275	617.6785	407.4338	264.6229	278.0606	442.4328	680.9801	914.4219	1112.1195	(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													
	464.0627	369.2930	308.6556	168.5396	69.5595	0.0000	0.0000	0.0000	0.0000	163.2188	319.4670	469.6987	(98)
Space heating												2332.4948	(98)
Space heating per m2											(98) / (4) =	38.2389	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 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 %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2577.3423	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	464.0627	369.2930	308.6556	168.5396	69.5595	0.0000	0.0000	0.0000	0.0000	163.2188	319.4670	469.6987	(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)													
	512.7765	408.0586	341.0559	186.2316	76.8613	0.0000	0.0000	0.0000	0.0000	180.3523	353.0022	519.0041	(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													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6977	89.6376	89.4933	89.1370	88.4672	87.3000	87.3000	87.3000	87.3000	89.0826	89.5265	89.7220	(217)
Fuel for water heating, kWh/month													
	166.9826	146.6230	152.7135	135.3364	132.0872	117.3673	110.6057	124.2964	125.0046	140.5411	150.5082	162.2195	(219)
Water heating fuel used												1664.2855	(219)
Annual totals kWh/year													
Space heating fuel - main system												2577.3423	(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)												300.9639	(232)
Total delivered energy for all uses												4617.5918	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2577.3423	3.4800	89.6915	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1664.2855	3.4800	57.9171	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	300.9639	13.1900	39.6971	(250)
Additional standing charges			120.0000	(251)
Total energy cost			317.1983	(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] =	1.2568	(257)
SAP value		82.4670	
SAP rating (Section 12)		82	(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	2577.3423	0.2160	556.7059	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1664.2855	0.2160	359.4857	(264)
Space and water heating			916.1916	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	300.9639	0.5190	156.2003	(268)
Total kg/year			1111.3169	(272)
CO2 emissions per m2			18.2200	(273)
EI value			85.9510	
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 / 0.8866 = 3.925, stars = 4
Water heating environmental impact	0.216 / 0.8866 = 0.2436, 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	60.9980 (1b)	x	2.3770 (2b)	=	144.9922	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9980					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.9922	(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) =	0.2069	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4574	(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) =	0.4574	(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	0.5260	0.4803	0.4688	0.4574	0.4803	0.4231	0.4460	0.4231	0.4231	0.4574	0.4460	0.4688	(22b)
Effective ac	0.6383	0.6153	0.6099	0.6046	0.6153	0.5895	0.5994	0.5895	0.5895	0.6046	0.5994	0.6099	(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)			7.7400	1.2357	9.5646			(27)
Flr - Ground			60.9980	0.1782	10.8704	75.6000	4611.4488	(28a)
Brick	69.4690	9.8420	59.6270	0.2700	16.0993	107.1000	6386.0517	(29a)
Total net area of external elements Aum(A, m2)			130.4650					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0543			(33)
Party Ceiling			60.9980			7.4000	451.3852	(32b)
Stud			80.8798			7.4000	598.5105	(32c)
Block			33.0403			54.0300	1785.1674	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13832.5636 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		226.7708 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.0334 (36)
Total fabric heat loss	(33) + (36) =	44.0877 (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	30.5433	29.4421	29.1825	28.9291	29.4421	28.2064	28.6819	28.2064	28.2064	28.9291	28.6819	29.1825	(38)
Heat transfer coeff	74.6310	73.5298	73.2702	73.0168	73.5298	72.2941	72.7697	72.2941	72.2941	73.0168	72.7697	73.2702	(39)
Average = Sum(39)m / 12 =												73.0572	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2235	1.2054	1.2012	1.1970	1.2054	1.1852	1.1930	1.1852	1.1852	1.1970	1.1930	1.2012	(40)
HLP (average)												1.1977	(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	2.0097 (42)
Average daily hot water use (litres/day)	81.9305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	90.1236	86.8464	83.5691	80.2919	77.0147	73.7375	73.7375	77.0147	80.2919	83.5691	86.8464	90.1236	(44)
Energy conte	133.6507	116.8917	120.6218	105.1610	100.9045	87.0729	80.6858	92.5882	93.6940	109.1913	119.1909	129.4335	(45)
Energy content (annual)										Total = Sum(45)m =		1289.0864	(45)
Distribution loss (46)m = 0.15 x (45)m	20.0476	17.5338	18.0933	15.7742	15.1357	13.0609	12.1029	13.8882	14.0541	16.3787	17.8786	19.4150	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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	(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	16.1290	14.5375	16.0464	15.4737	15.9495	15.3888	15.8730	15.9226	15.4351	16.0063	15.5539	16.1130	(61)
Total heat required for water heating calculated for each month													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(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													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(64)
								Total per year (kWh/year) = Sum(64)m =				1477.5150	(64)
Heat gains from water heating, kWh/month													
	48.4711	42.5009	44.1184	38.8345	37.5381	32.7989	30.7963	34.7662	35.0120	40.3077	43.5194	47.0649	(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	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	120.5824	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	42.6046	37.8410	30.7744	23.2982	17.4157	14.7030	15.8871	20.6507	27.7173	35.1935	41.0760	43.7887	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	261.8757	264.5931	257.7453	243.1669	224.7644	207.4686	195.9139	193.1965	200.0444	214.6227	233.0253	250.3210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	49.0679	(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)													
	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	-80.3883	(71)
Water heating gains (Table 5)													
	65.1493	63.2454	59.2989	53.9368	50.4544	45.5541	41.3929	46.7288	48.6278	54.1770	60.4436	63.2593	(72)
Total internal gains													
	461.8917	457.9416	440.0806	412.6639	384.8966	359.9878	345.4560	352.8381	368.6516	396.2553	426.8070	449.6311	(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	3.2400	14.6401	0.7600	0.7200	0.7700	17.9874	(74)
East	1.2600	27.3735	0.7600	0.7200	0.7700	13.0792	(76)
West	3.2400	27.3735	0.7600	0.7200	0.7700	33.6321	(80)

Solar gains	64.6986	103.5920	171.7964	263.2558	319.7505	354.7057	335.6629	282.5290	214.5111	131.3719	77.1758	51.7629	(83)
Total gains	526.5903	561.5336	611.8770	675.9197	704.6471	714.6935	681.1189	635.3671	583.1627	527.6273	503.9828	501.3940	(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	51.4850	52.2560	52.4412	52.6232	52.2560	53.1492	52.8019	53.1492	53.1492	52.6232	52.8019	52.4412	
alpha	4.4323	4.4837	4.4961	4.5082	4.4837	4.5433	4.5201	4.5433	4.5433	4.5082	4.5201	4.4961	
util living area													
	0.9839	0.9773	0.9538	0.8841	0.7371	0.5121	0.3505	0.3617	0.6565	0.8956	0.9687	0.9857	(86)
MIT	19.9294	20.0528	20.3207	20.6495	20.8869	20.9837	20.9977	20.9975	20.9518	20.6960	20.2936	19.9447	(87)
Th 2	19.9012	19.9156	19.9190	19.9224	19.9156	19.9319	19.9256	19.9319	19.9319	19.9224	19.9256	19.9190	(88)
util rest of house													
	0.9790	0.9705	0.9395	0.8494	0.6658	0.4133	0.2375	0.2423	0.5536	0.8540	0.9575	0.9813	(89)
MIT 2	18.9607	19.0932	19.3558	19.6627	19.8509	19.9264	19.9253	19.9316	19.9120	19.7118	19.3388	18.9904	(90)
Living area fraction									fLA = Living area / (4) =			0.4454	(91)
MIT	19.3922	19.5206	19.7856	20.1023	20.3124	20.3973	20.4030	20.4064	20.3752	20.1502	19.7641	19.4155	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2422	19.3706	19.6356	19.9523	20.1624	20.2473	20.2530	20.2564	20.2252	20.0002	19.6141	19.2655	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9753	0.9662	0.9350	0.8505	0.6832	0.4432	0.2722	0.2789	0.5835	0.8575	0.9534	0.9778	(94)
Useful gains	513.5581	542.5425	572.1291	574.8535	481.4314	316.7642	185.3983	177.1900	340.2975	452.4287	480.5206	490.2682	(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													
	1040.5200	1005.2001	896.5031	733.9845	526.6484	321.5147	185.7790	177.5809	356.0600	584.1487	816.0457	1008.5973	(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													
	392.0596	310.9059	241.3342	114.5743	33.6414	0.0000	0.0000	0.0000	0.0000	97.9997	241.5780	385.6369	(98)
Space heating												1817.7301	(98)
Space heating per m2											(98) / (4) =	29.7998	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2008.5416	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	392.0596	310.9059	241.3342	114.5743	33.6414	0.0000	0.0000	0.0000	0.0000	97.9997	241.5780	385.6369	(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)													
	433.2151	343.5425	266.6677	126.6015	37.1728	0.0000	0.0000	0.0000	0.0000	108.2870	266.9371	426.1181	(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													
	149.7796	131.4293	136.6682	120.6347	116.8540	102.4617	96.5588	108.5107	109.1290	125.1976	134.7447	145.5465	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5922	89.5250	89.3163	88.8300	87.9955	87.3000	87.3000	87.3000	87.3000	88.6767	89.3276	89.6001	(217)
Fuel for water heating, kWh/month													
	167.1793	146.8074	153.0160	135.8040	132.7953	117.3673	110.6057	124.2964	125.0046	141.1843	150.8433	162.4402	(219)
Water heating fuel used												1667.3440	(219)
Annual totals kWh/year													
Space heating fuel - main system												2008.5416	(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)												300.9639	(232)
Total delivered energy for all uses												4051.8495	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2008.5416	3.7400	75.1195	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1667.3440	3.7400	62.3587	(247)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Energy for lighting	300.9639	20.4300	61.4869	(250)
Additional standing charges			95.0000	(251)
Total energy cost			309.2876	(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	2008.5416	0.2160	433.8450	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1667.3440	0.2160	360.1463	(264)
Space and water heating			793.9913	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	300.9639	0.5190	156.2003	(268)
Total kg/year			989.1166	(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	2008.5416	1.2200	2450.4207	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1667.3440	1.2200	2034.1597	(264)
Space and water heating			4484.5804	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	300.9639	3.0700	923.9593	(268)
Primary energy kWh/year			5638.7897	(272)
Primary energy kWh/m2/year			92.4422	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 82
Current environmental impact rating:	B 86

(For testing purposes):

A	Not considered
B	Not considered

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

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	CO2 change
(none)			

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

Potential energy efficiency rating: B 82
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	£77	£77	£0
Mains gas	£232	£232	£0
Space heating	£185	£185	£0
Water heating	£62	£62	£0
Lighting	£61	£61	£0
Total cost of fuels	£309	£309	£0
Total cost of uses	£308	£308	£0
Delivered energy	66 kWh/m²	66 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	16 kg/m²	16 kg/m²	0 kg/m²
Primary energy	92 kWh/m²	92 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS 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 ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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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	180 - PRJ012848	**Issued on Date**	16/11/2022
Assessment Reference	180	**Prop Type Ref**	2BF03 SAT GF 4.9
Property	Southbourne, PO10		

SAP Rating	82 B	**DER**	20.47	**TER**	20.61
Environmental	86 B	**% DER<TER**	0.66		
CO_2 Emissions (t/year)	0.99	**DFEE**	50.23	**TFEE**	55.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.28		

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)	20.61	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	20.47	$kgCO_2/m^2$	Pass
	-0.14 (-0.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.23	$kWh/m^2/yr$	
	-5.2 (-9.4%)	$kWh/m^2/yr$	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
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	3.24 m², No overhang		
Windows facing East	1.26 m², No overhang		
Windows facing West	3.24 m², No overhang		
Air change rate	4.74 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	
Thermal bridging y-value	0.039	W/m²K	