PREDICTED ENERGY ASSESSMENT

Design SAP
elmhurst energy

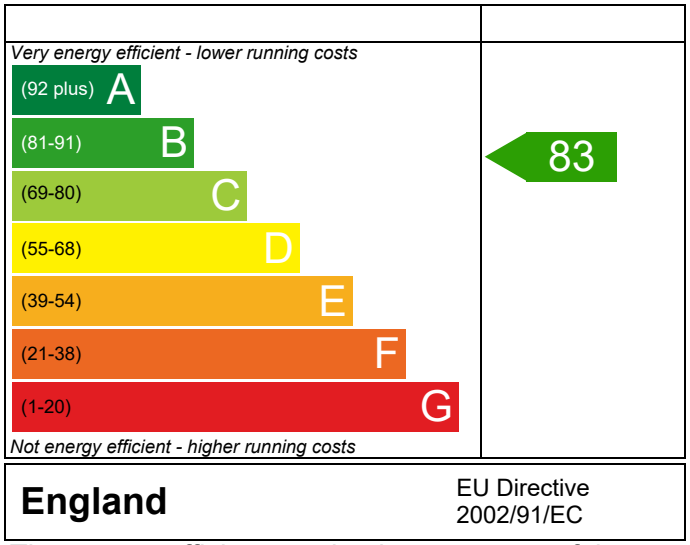
Plot 224

Dwelling type:	House, End-Terrace
Date of assessment:	16/05/2022
Produced by:	Scott Binstead
Total floor area:	70.34 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.

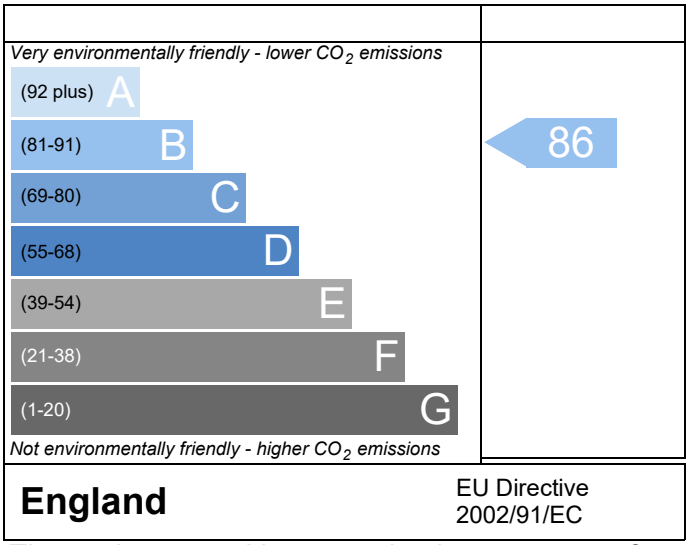
Energy Efficiency Rating



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	224	**Issued on Date**	16/05/2022
Assessment Reference	224 S	**Prop Type Ref**	2B3P
Property	Plot 224		

SAP Rating	83 B	**DER**	19.38	**TER**	20.01
Environmental	86 B	**% DER<TER**	3.13		
CO_2 Emissions (t/year)	1.13	**DFEE**	48.62	**TFEE**	54.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.97		

Assessor Details	Chris Nicholls, , Tel: ,	**Assessor ID**	U903-0001
Client			

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

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

End-Terrace House, total floor area 70 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
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1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.38 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.6 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.24 (max. 0.30)        0.24 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           0.16 (max. 0.25)        0.16 (max. 0.70)          OK
Roof            0.11 (max. 0.20)        0.11 (max. 0.35)          OK
Openings        1.23 (max. 2.00)        1.40 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         5.01 (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 30
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 (Thames Valley):       Slight                                          OK
Based on:
Overshading:                            Average
Windows facing North:                   2.85 m², No overhang
Windows facing South:                   3.27 m², No overhang
Air change rate:                        4.55 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
Door U-value                            1.00 W/m²K




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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700	(1b)	x 2.4500	(2b) =	86.1665	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6900	(2c) =	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.7738	(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) =	0.1660	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4165	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3852	(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	0.4912	0.4815	0.4719	0.4237	0.4141	0.3660	0.3660	0.3563	0.3852	0.4141	0.4334	0.4526	(22b)
Effective ac	0.6206	0.6159	0.6113	0.5898	0.5857	0.5670	0.5670	0.5635	0.5742	0.5857	0.5939	0.6024	(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	
Windows (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Solid Door			4.3300	1.0000	4.3200			(26)
Flr - Ground			35.1700	0.1600	5.6272	75.6000	2658.8520	(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.2400	18.1980	38.9400	2952.6255	(29a)
Rf - Ins Joist	35.1700		35.1700	0.1100	3.8687	5.8200	204.6894	(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1275			(33)
Party Wall			40.3070	0.0000	0.0000	54.0300	2177.7872	(32)
Ground Floor Stud			74.5285			5.8200	433.7558	(32c)
1st Floor Stud			73.1348			5.8200	425.6443	(32c)
Internal Floor			35.1700			18.0000	633.0600	(32d)
Internal Ceiling			35.1700			5.8200	204.6894	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9691.1037 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		137.7751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8142 (36)
Total fabric heat loss	(33) + (36) =	48.9417 (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	37.0231	36.7437	36.4698	35.1834	34.9428	33.8224	33.8224	33.6149	34.2539	34.9428	35.4296	35.9387	(38)
Heat transfer coeff	85.9648	85.6854	85.4115	84.1252	83.8845	82.7641	82.7641	82.5566	83.1956	83.8845	84.3714	84.8804	(39)
Average = Sum(39)m / 12 =												84.1240	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2221	1.2182	1.2143	1.1960	1.1926	1.1766	1.1766	1.1737	1.1828	1.1926	1.1995	1.2067	(40)
HLP (average)												1.1960	(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	2.2544 (42)
Average daily hot water use (litres/day)	87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m													
	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6313	13.1904	14.5637	14.0488	14.4843	13.9792	14.4216	14.4622	14.0171	14.5309	14.1144	14.6183	(61)
Total heat required for water heating calculated for each month													
	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(64)
Total per year (kWh/year) = Sum(64)m =												1551.5673	(64)
Heat gains from water heating, kWh/month													
	51.2482	44.9204	46.5919	40.9579	39.5511	34.4997	32.3360	36.5844	36.8668	42.5136	45.9701	49.7433	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.8628	18.5301	15.0697	11.4087	8.5282	7.1998	7.7797	10.1123	13.5727	17.2337	20.1143	21.4426	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	68.8820	66.8458	62.6236	56.8860	53.1601	47.9163	43.4624	49.1725	51.2039	57.1419	63.8474	66.8592	(72)
Total internal gains													
	347.6493	345.3361	332.4735	312.0475	291.5209	271.8658	259.2515	265.2388	275.9105	296.5368	320.0430	337.4662	(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	2.8480	10.6334	0.7600	0.7200	0.7700	11.4839	(74)
South	3.2700	46.7521	0.7600	0.7200	0.7700	57.9733	(78)

Solar gains	69.4572	116.8917	158.2358	196.5934	223.1341	223.4643	214.5863	194.0562	171.1772	128.5317	82.8850	59.6678	(83)
Total gains	417.1065	462.2278	490.7093	508.6409	514.6550	495.3301	473.8378	459.2950	447.0877	425.0686	402.9280	397.1340	(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	31.3148	31.4169	31.5177	31.9996	32.0914	32.5259	32.5259	32.6076	32.3571	32.0914	31.9062	31.7149	
alpha	3.0877	3.0945	3.1012	3.1333	3.1394	3.1684	3.1684	3.1738	3.1571	3.1394	3.1271	3.1143	
util living area													
	0.9843	0.9772	0.9650	0.9397	0.8877	0.7849	0.6526	0.6839	0.8445	0.9435	0.9765	0.9865	(86)
MIT	18.9209	19.1159	19.4451	19.8968	20.3389	20.7106	20.8871	20.8650	20.5971	20.0360	19.4093	18.8933	(87)
Th 2	19.9023	19.9055	19.9086	19.9232	19.9260	19.9387	19.9387	19.9411	19.9338	19.9260	19.9204	19.9146	(88)
util rest of house													
	0.9811	0.9726	0.9574	0.9250	0.8560	0.7150	0.5339	0.5715	0.7897	0.9269	0.9709	0.9838	(89)
MIT 2	18.0119	18.2075	18.5356	18.9898	19.4157	19.7587	19.8908	19.8797	19.6625	19.1318	18.5111	17.9934	(90)
Living area fraction									fLA = Living area / (4) =			0.2273	(91)
MIT	18.2185	18.4140	18.7424	19.1960	19.6256	19.9751	20.1173	20.1037	19.8750	19.3374	18.7153	18.1979	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.0685	18.2640	18.5924	19.0460	19.4756	19.8251	19.9673	19.9537	19.7250	19.1874	18.5653	18.0479	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9738	0.9631	0.9452	0.9095	0.8396	0.7062	0.5376	0.5730	0.7765	0.9118	0.9612	0.9772	(94)
Useful gains	406.1639	445.1715	463.8185	462.6296	432.0895	349.8219	254.7121	263.1795	347.1604	387.5830	387.3070	388.0711	(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													
	1183.6098	1145.1037	1032.8276	853.5330	652.2531	432.4466	278.6929	293.3816	467.9728	720.3471	967.3410	1175.4177	(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													
	578.4198	470.3545	423.3428	281.4504	163.8017	0.0000	0.0000	0.0000	0.0000	247.5765	417.6245	585.7859	(98)
Space heating												3168.3560	(98)
Space heating per m2											(98) / (4) =	45.0434	(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	3500.9459	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	578.4198	470.3545	423.3428	281.4504	163.8017	0.0000	0.0000	0.0000	0.0000	247.5765	417.6245	585.7859	(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)													
	639.1379	519.7287	467.7821	310.9949	180.9963	0.0000	0.0000	0.0000	0.0000	273.5652	461.4635	647.2772	(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													
	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7947	89.7522	89.6669	89.4820	89.1023	87.3000	87.3000	87.3000	87.3000	89.3639	89.6671	89.8174	(217)
Fuel for water heating, kWh/month													
	175.6899	154.1709	160.3041	141.5565	137.5326	122.8260	115.4977	130.1450	130.9916	147.1128	158.0937	170.6027	(219)
Water heating fuel used												1744.5236	(219)
Annual totals kWh/year													
Space heating fuel - main system												3500.9459	(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)	368.4427	(232)
Total delivered energy for all uses	5688.9121	(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	3500.9459	0.2160	756.2043	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1744.5236	0.2160	376.8171	(264)
Space and water heating			1133.0214	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	368.4427	0.5190	191.2218	(268)
Total CO2, kg/year			1363.1682	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.3800	(273)

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

DER		19.3800	ZC1
Total Floor Area	TFA	70.3400	
Assumed number of occupants	N	2.2544	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6880	ZC2
CO2 emissions from cooking, equation (L16)		2.4610	ZC3
Total CO2 emissions		38.5290	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		38.5290	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	35.1700 (1b)	x	2.4500 (2b)	=	86.1665	(1b) - (3b)
First floor	35.1700 (1c)	x	2.6900 (2c)	=	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.7738	(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) =	0.1660	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4160	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3848	(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	0.4906	0.4809	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521	(22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022	(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			4.3300	1.0000	4.3200			(26)
TER Opening Type (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Flr - Ground			35.1700	0.1300	4.5721			(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.1800	13.6485			(29a)
Rf - Ins Joist	35.1700		35.1700	0.1300	4.5721			(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2263			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3197	(36)
Total fabric heat loss (33) + (36) =	43.5460	(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	37.0058	36.7271	36.4539	35.1706	34.9305	33.8128	33.8128	33.6058	34.2433	34.9305	35.4162	35.9240	(38)
Heat transfer coeff	80.5519	80.2731	79.9999	78.7166	78.4765	77.3588	77.3588	77.1518	77.7893	78.4765	78.9622	79.4700	(39)
Average = Sum(39)m / 12 =												78.7155	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1452	1.1412	1.1373	1.1191	1.1157	1.0998	1.0998	1.0968	1.1059	1.1157	1.1226	1.1298	(40)
HLP (average)												1.1191	(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	2.2544 (42)
Average daily hot water use (litres/day)	87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(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	49.1829	42.8079	45.6060	42.4041	42.0291	38.9425	40.2406	42.0291	42.4041	45.6060	45.8656	49.1829	(61)
Total heat required for water heating calculated for each month													
	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(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													
	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(64)
								Total per year (kWh/year) = Sum(64)m =				1906.8058	(64)
Heat gains from water heating, kWh/month													
	59.8861	52.3248	54.3525	48.0468	46.4373	40.7406	38.7908	43.4761	43.9636	50.2823	53.9079	58.3844	(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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9792	18.6335	15.1538	11.4724	8.5757	7.2400	7.8231	10.1687	13.6485	17.3299	20.2265	21.5622	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	80.4920	77.8643	73.0545	66.7316	62.4158	56.5841	52.1381	58.4356	61.0605	67.5838	74.8721	78.4737	(72)
Total internal gains													
	359.3758	356.4579	342.9884	321.9568	300.8242	280.5738	267.9707	274.5582	285.8428	307.0749	331.1799	349.2003	(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	2.8480	10.6334	0.6300	0.7000	0.7700	9.2552	(74)
South	3.2700	46.7521	0.6300	0.7000	0.7700	46.7219	(78)

Solar gains	55.9770	94.2055	127.5255	158.4387	179.8284	180.0946	172.9396	156.3940	137.9553	103.5864	66.7988	48.0876	(83)
Total gains	415.3528	450.6634	470.5140	480.3955	480.6526	460.6684	440.9103	430.9522	423.7981	410.6613	397.9787	397.2878	(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	60.6407	60.8513	61.0591	62.0545	62.2444	63.1437	63.1437	63.3131	62.7942	62.2444	61.8615	61.4662	
alpha	5.0427	5.0568	5.0706	5.1370	5.1496	5.2096	5.2096	5.2209	5.1863	5.1496	5.1241	5.0977	
util living area													
	0.9982	0.9968	0.9939	0.9850	0.9570	0.8676	0.7148	0.7483	0.9196	0.9853	0.9965	0.9985	(86)
MIT	19.7564	19.8724	20.0734	20.3565	20.6374	20.8714	20.9660	20.9563	20.8021	20.4471	20.0593	19.7425	(87)
Th 2	19.9641	19.9673	19.9705	19.9853	19.9881	20.0010	20.0010	20.0034	19.9960	19.9881	19.9824	19.9766	(88)
util rest of house													
	0.9975	0.9957	0.9915	0.9785	0.9349	0.7954	0.5797	0.6203	0.8696	0.9776	0.9950	0.9980	(89)
MIT 2	18.3054	18.4772	18.7726	19.1937	19.5924	19.8996	19.9862	19.9823	19.8183	19.3282	18.7615	18.2940	(90)
Living area fraction									fLA = Living area / (4) =			0.2273	(91)
MIT	18.6353	18.7944	19.0683	19.4580	19.8300	20.1205	20.2089	20.2037	20.0420	19.5826	19.0565	18.6233	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6353	18.7944	19.0683	19.4580	19.8300	20.1205	20.2089	20.2037	20.0420	19.5826	19.0565	18.6233	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9939	0.9886	0.9738	0.9304	0.8056	0.6104	0.6488	0.8724	0.9732	0.9930	0.9970	(94)
Useful gains	413.8167	447.9045	465.1362	467.8258	447.2196	371.1043	269.1220	279.5984	369.7324	399.6554	395.2121	396.1152	(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													
	1154.7312	1115.3457	1005.4653	831.0895	638.0102	427.0581	279.1827	293.4618	462.2221	704.9218	944.1138	1146.2164	(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													
	551.2404	448.5205	402.0048	261.5498	141.9482	0.0000	0.0000	0.0000	0.0000	227.1182	395.2092	558.0753	(98)
Space heating												2985.6665	(98)
Space heating per m2											(98) / (4) =	42.4462	(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												3196.6450	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	551.2404	448.5205	402.0048	261.5498	141.9482	0.0000	0.0000	0.0000	0.0000	227.1182	395.2092	558.0753	(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)													
	590.1932	480.2146	430.4120	280.0319	151.9789	0.0000	0.0000	0.0000	0.0000	243.1673	423.1362	597.5110	(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													
	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5518	87.4044	87.0810	86.3578	84.9111	80.3000	80.3000	80.3000	80.3000	85.8935	87.0592	87.6250	(217)
Fuel for water heating, kWh/month													
	219.6548	192.1977	200.7120	179.5121	176.7606	164.6207	157.7191	175.8199	177.7616	189.2355	199.3001	214.3172	(219)
Water heating fuel used												2247.6114	(219)
Annual totals kWh/year													
Space heating fuel - main system												3196.6450	(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)												370.4985	(232)
Total delivered energy for all uses												5889.7549	(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	3196.6450	0.2160	690.4753	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2247.6114	0.2160	485.4841	(264)
Space and water heating			1175.9594	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	370.4985	0.5190	192.2887	(268)
Total CO2, kg/m2/year			1407.1731	(272)
Emissions per m2 for space and water heating			16.7182	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.7337	(272b)
Emissions per m2 for pumps and fans			0.5534	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7182 * 1.00) + 2.7337 + 0.5534, rounded to 2 d.p.			20.0100	(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	35.1700	(1b)	x 2.4500	(2b) =	86.1665	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6900	(2c) =	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.7738	(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) =	0.1660	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.4165	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3852	(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	0.4912	0.4815	0.4719	0.4237	0.4141	0.3660	0.3660	0.3563	0.3852	0.4141	0.4334	0.4526	(22b)
Effective ac	0.6206	0.6159	0.6113	0.5898	0.5857	0.5670	0.5670	0.5635	0.5742	0.5857	0.5939	0.6024	(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	
Windows (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Solid Door			4.3300	1.0000	4.3200			(26)
Flr - Ground			35.1700	0.1600	5.6272	75.6000	2658.8520	(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.2400	18.1980	38.9400	2952.6255	(29a)
Rf - Ins Joist	35.1700		35.1700	0.1100	3.8687	5.8200	204.6894	(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1275			(33)
Party Wall			40.3070	0.0000	0.0000	54.0300	2177.7872	(32)
Ground Floor Stud			74.5285			5.8200	433.7558	(32c)
1st Floor Stud			73.1348			5.8200	425.6443	(32c)
Internal Floor			35.1700			18.0000	633.0600	(32d)
Internal Ceiling			35.1700			5.8200	204.6894	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9691.1037 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		137.7751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8142 (36)
Total fabric heat loss	(33) + (36) =	48.9417 (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	37.0231	36.7437	36.4698	35.1834	34.9428	33.8224	33.8224	33.6149	34.2539	34.9428	35.4296	35.9387	(38)
Heat transfer coeff	85.9648	85.6854	85.4115	84.1252	83.8845	82.7641	82.7641	82.5566	83.1956	83.8845	84.3714	84.8804	(39)
Average = Sum(39)m / 12 =												84.1240	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2221	1.2182	1.2143	1.1960	1.1926	1.1766	1.1766	1.1737	1.1828	1.1926	1.1995	1.2067	(40)
HLP (average)												1.1960	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.4149	26.6010	27.4499	23.9315	22.9628	19.8152	18.3617	21.0703	21.3219	24.8487	27.1243	29.4552	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8628	18.5301	15.0697	11.4087	8.5282	7.1998	7.7797	10.1123	13.5727	17.2337	20.1143	21.4426	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	40.8802	39.5849	36.8950	33.2382	30.8640	27.5211	24.6797	28.3203	29.6138	33.3987	37.6726	39.5903	(72)
Total internal gains	316.6475	315.0751	303.7449	285.3997	266.2248	248.4706	237.4688	241.3865	251.3203	269.7937	290.8682	307.1972	(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	2.8480	10.6334	0.7600	0.7200	0.7700	11.4839	(74)
South	3.2700	46.7521	0.7600	0.7200	0.7700	57.9733	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	69.4572	116.8917	158.2358	196.5934	223.1341	223.4643	214.5863	194.0562	171.1772	128.5317	82.8850	59.6678	(83)
Total gains	386.1048	431.9668	461.9807	481.9931	489.3589	471.9349	452.0551	435.4427	422.4975	398.3254	373.7532	366.8651	(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	31.3148	31.4169	31.5177	31.9996	32.0914	32.5259	32.5259	32.6076	32.3571	32.0914	31.9062	31.7149	
alpha	3.0877	3.0945	3.1012	3.1333	3.1394	3.1684	3.1684	3.1738	3.1571	3.1394	3.1271	3.1143	
util living area	0.9873	0.9809	0.9700	0.9470	0.8992	0.8020	0.6726	0.7061	0.8608	0.9518	0.9808	0.9891	(86)
MIT	18.8613	19.0592	19.3935	19.8529	20.3045	20.6894	20.8766	20.8514	20.5686	19.9912	19.3545	18.8344	(87)
Th 2	19.9023	19.9055	19.9086	19.9232	19.9260	19.9387	19.9387	19.9411	19.9338	19.9260	19.9204	19.9146	(88)
util rest of house	0.9847	0.9770	0.9634	0.9338	0.8697	0.7345	0.5539	0.5945	0.8092	0.9372	0.9761	0.9869	(89)
MIT 2	17.9530	18.1517	18.4853	18.9481	19.3852	19.7431	19.8855	19.8723	19.6397	19.0895	18.4572	17.9351	(90)
Living area fraction									fLA = Living area / (4) =			0.2273	(91)
MIT	18.1595	18.3580	18.6918	19.1538	19.5942	19.9583	20.1108	20.0949	19.8508	19.2945	18.6612	18.1395	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1595	18.3580	18.6918	19.1538	19.5942	19.9583	20.1108	20.0949	19.8508	19.2945	18.6612	18.1395	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9789	0.9695	0.9536	0.9217	0.8586	0.7360	0.5755	0.6129	0.8044	0.9260	0.9687	0.9819	(94)
Useful gains	377.9767	418.7878	440.5438	444.2567	420.1537	347.3208	260.1619	266.8789	339.8499	368.8466	362.0492	360.2115	(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	1191.4268	1153.1532	1041.3167	862.6022	662.1973	443.4713	290.5683	305.0355	478.4436	729.3339	975.4345	1183.1918	(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	605.2069	493.4936	446.9750	301.2087	180.0804	0.0000	0.0000	0.0000	0.0000	268.2026	441.6374	612.2974	(98)
Space heating												3349.1020	(98)
Space heating per m2											(98) / (4) =	47.6131	(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	777.9824	612.4543	627.4302	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6794	0.7598	0.7395	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	528.5494	465.3521	463.9644	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	636.8106	611.9969	594.4049	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	77.9481	109.1037	97.0477	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												284.0995 (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	19.4870	27.2759	24.2619	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												71.0249 (107)
Space cooling per m2												1.0097 (108)
Energy for space heating												47.6131 (99)
Energy for space cooling												1.0097 (108)
Total												48.6228 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.6 (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	35.1700 (1b)	x	2.4500 (2b)	=	86.1665	(1b) - (3b)
First floor	35.1700 (1c)	x	2.6900 (2c)	=	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.7738	(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) =	0.1660	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4160	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3848	(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	0.4906	0.4809	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521	(22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022	(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			4.3300	1.0000	4.3200			(26)
TER Opening Type (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Flr - Ground			35.1700	0.1300	4.5721			(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.1800	13.6485			(29a)
Rf - Ins Joist	35.1700		35.1700	0.1300	4.5721			(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2263			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3197	(36)
Total fabric heat loss (33) + (36) =	43.5460	(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	37.0058	36.7271	36.4539	35.1706	34.9305	33.8128	33.8128	33.6058	34.2433	34.9305	35.4162	35.9240	(38)
Heat transfer coeff	80.5519	80.2731	79.9999	78.7166	78.4765	77.3588	77.3588	77.1518	77.7893	78.4765	78.9622	79.4700	(39)
Average = Sum(39)m / 12 =												78.7155	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1452	1.1412	1.1373	1.1191	1.1157	1.0998	1.0998	1.0968	1.1059	1.1157	1.1226	1.1298	(40)
HLP (average)												1.1191	(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	2.2544	(42)
Average daily hot water use (litres/day)	87.7408	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(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													
	30.4149	26.6010	27.4499	23.9315	22.9628	19.8152	18.3617	21.0703	21.3219	24.8487	27.1243	29.4552	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9792	18.6335	15.1538	11.4724	8.5757	7.2400	7.8231	10.1687	13.6485	17.3299	20.2265	21.5622	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	40.8802	39.5849	36.8950	33.2382	30.8640	27.5211	24.6797	28.3203	29.6138	33.3987	37.6726	39.5903	(72)
Total internal gains													
	316.7639	315.1785	303.8290	285.4633	266.2724	248.5108	237.5122	241.4429	251.3961	269.8898	290.9804	307.3169	(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	2.8480	10.6334	0.6300	0.7000	0.7700	9.2552	(74)
South	3.2700	46.7521	0.6300	0.7000	0.7700	46.7219	(78)

Solar gains	55.9770	94.2055	127.5255	158.4387	179.8284	180.0946	172.9396	156.3940	137.9553	103.5864	66.7988	48.0876	(83)
Total gains	372.7410	409.3840	431.3545	443.9021	446.1008	428.6053	410.4518	397.8369	389.3514	373.4763	357.7792	355.4044	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6407	60.8513	61.0591	62.0545	62.2444	63.1437	63.1437	63.3131	62.7942	62.2444	61.8615	61.4662	
alpha	5.0427	5.0568	5.0706	5.1370	5.1496	5.2096	5.2096	5.2209	5.1863	5.1496	5.1241	5.0977	
util living area													
	0.9989	0.9980	0.9958	0.9893	0.9676	0.8929	0.7516	0.7878	0.9398	0.9902	0.9978	0.9991	(86)
MIT	19.6999	19.8180	20.0225	20.3108	20.5994	20.8486	20.9570	20.9441	20.7701	20.4003	20.0062	19.6867	(87)
Th 2	19.9641	19.9673	19.9705	19.9853	19.9881	20.0010	20.0010	20.0034	19.9960	19.9881	19.9824	19.9766	(88)
util rest of house													
	0.9985	0.9972	0.9942	0.9845	0.9500	0.8281	0.6168	0.6625	0.8986	0.9849	0.9969	0.9988	(89)
MIT 2	18.7753	18.8958	19.1022	19.4004	19.6836	19.9163	19.9876	19.9839	19.8496	19.4924	19.0961	18.7721	(90)
Living area fraction									fLA = Living area / (4) =			0.2273	(91)
MIT	18.9855	19.1054	19.3114	19.6074	19.8918	20.1282	20.2080	20.2022	20.0588	19.6988	19.3030	18.9800	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9855	19.1054	19.3114	19.6074	19.8918	20.1282	20.2080	20.2022	20.0588	19.6988	19.3030	18.9800	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9964	0.9928	0.9821	0.9479	0.8380	0.6479	0.6909	0.9019	0.9827	0.9961	0.9984	(94)
Useful gains	371.9855	407.9044	428.2350	435.9483	422.8405	359.1820	265.9300	274.8702	351.1396	367.0275	356.3722	354.8447	(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													
	1182.9429	1140.3149	1024.9122	842.8471	642.8612	427.6541	279.1097	293.3465	463.5336	714.0406	963.5741	1174.5694	(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													
	603.3523	492.1799	443.9278	292.9672	163.6954	0.0000	0.0000	0.0000	0.0000	258.1777	437.1854	609.8752	(98)
Space heating												3301.3609	(98)
Space heating per m2											(98) / (4) =	46.9343	(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	727.1728	572.4552	586.3539	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7372	0.8322	0.8117	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	536.0817	476.4069	475.9255	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	586.2192	563.4274	550.5251	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	36.0990	64.7433	55.5021	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												156.3444	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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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    9.0248   16.1858   13.8755    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              39.0861 (107)
Space cooling per m2                                                                                                        0.5557 (108)
Energy for space heating                                                                                                   46.9343 (99)
Energy for space cooling                                                                                                    0.5557 (108)
Total                                                                                                                      47.4900 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        54.6 (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	35.1700	(1b)	x 2.4500	(2b) =	86.1665	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6900	(2c) =	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.7738	(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) =	0.1660	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.4165	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3852	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.4045	0.3852	0.3852	0.3563	0.3563	0.3178	0.3274	0.3082	0.3178	0.3371	0.3371	0.3660	(22b)
Effective ac	0.5818	0.5742	0.5742	0.5635	0.5635	0.5505	0.5536	0.5475	0.5505	0.5568	0.5568	0.5670	(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	
Windows (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Solid Door			4.3300	1.0000	4.3200			(26)
Flr - Ground			35.1700	0.1600	5.6272	75.6000	2658.8520	(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.2400	18.1980	38.9400	2952.6255	(29a)
Rf - Ins Joist	35.1700		35.1700	0.1100	3.8687	5.8200	204.6894	(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1275			(33)
Party Wall			40.3070	0.0000	0.0000	54.0300	2177.7872	(32)
Ground Floor Stud			74.5285			5.8200	433.7558	(32c)
1st Floor Stud			73.1348			5.8200	425.6443	(32c)
Internal Floor			35.1700			18.0000	633.0600	(32d)
Internal Ceiling			35.1700			5.8200	204.6894	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9691.1037 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		137.7751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8142 (36)
Total fabric heat loss	(33) + (36) =	48.9417 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.7076	34.2539	34.2539	33.6149	33.6149	32.8403	33.0256	32.6605	32.8403	33.2165	33.2165	33.8224	(38)
Heat transfer coeff	83.6493	83.1956	83.1956	82.5566	82.5566	81.7820	81.9674	81.6022	81.7820	82.1582	82.1582	82.7641	(39)
Average = Sum(39)m / 12 =												82.4473	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1892	1.1828	1.1828	1.1737	1.1737	1.1627	1.1653	1.1601	1.1627	1.1680	1.1680	1.1766	(40)
HLP (average)												1.1721	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 14.6313	13.1904	14.5637	14.0488	14.4843	13.9792	14.4216	14.4622	14.0171	14.5309	14.1144	14.6183	(61)

Total heat required for water heating calculated for each month

157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(62)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(64)
							Total per year (kWh/year) = Sum(64)m =				1551.5673	(64)
RHI water heating demand											1552	(64)

Heat gains from water heating, kWh/month

51.2482	44.9204	46.5919	40.9579	39.5511	34.4997	32.3360	36.5844	36.8668	42.5136	45.9701	49.7433	(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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)

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

52.1569	46.3253	37.6742	28.5218	21.3204	17.9996	19.4492	25.2808	33.9318	43.0842	50.2857	53.6065	(67)

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

295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)

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

50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)

-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)

Water heating gains (Table 5)

68.8820	66.8458	62.6236	56.8860	53.1601	47.9163	43.4624	49.1725	51.2039	57.1419	63.8474	66.8592	(72)

Total internal gains

515.5620	510.7622	490.1577	458.8089	427.1053	399.0138	382.9644	391.4382	409.8518	441.4010	476.0842	501.9437	(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	2.8480	11.9814	0.7600	0.7200	0.7700	12.9398	(74)
South	3.2700	50.9848	0.7600	0.7200	0.7700	63.2220	(78)

Solar gains 76.1618	115.3718	154.8040	199.7274	222.4125	239.0847	226.8163	208.5679	182.0098	135.5597	93.1047	64.8060	(83)
Total gains 591.7238	626.1340	644.9617	658.5364	649.5178	638.0985	609.7807	600.0061	591.8616	576.9607	569.1890	566.7498	(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	32.1816	32.3571	32.3571	32.6076	32.6076	32.9164	32.8420	32.9890	32.9164	32.7657	32.7657	32.5259	
alpha	3.1454	3.1571	3.1571	3.1738	3.1738	3.1944	3.1895	3.1993	3.1944	3.1844	3.1844	3.1684	
util living area													
	0.9550	0.9438	0.9193	0.8682	0.7667	0.5751	0.4014	0.4175	0.6717	0.8582	0.9322	0.9593	(86)
MIT	19.4342	19.5845	19.8956	20.2915	20.6660	20.9135	20.9808	20.9781	20.8417	20.4293	19.8933	19.4136	(87)
Th 2	19.9286	19.9338	19.9338	19.9411	19.9411	19.9500	19.9479	19.9520	19.9500	19.9457	19.9457	19.9387	(88)
util rest of house													
	0.9465	0.9333	0.9032	0.8396	0.7108	0.4761	0.2720	0.2886	0.5855	0.8221	0.9174	0.9516	(89)
MIT 2	18.5361	18.6867	18.9900	19.3736	19.7122	19.9103	19.9437	19.9470	19.8635	19.5105	19.0000	18.5238	(90)
Living area fraction									fLA = Living area / (4) =			0.2273	(91)
MIT	18.7402	18.8908	19.1959	19.5822	19.9290	20.1384	20.1795	20.1814	20.0858	19.7194	19.2031	18.7261	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5902	18.7408	19.0459	19.4322	19.7790	19.9884	20.0295	20.0314	19.9358	19.5694	19.0531	18.5761	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9330	0.9184	0.8866	0.8233	0.7011	0.4800	0.2824	0.2988	0.5842	0.8067	0.9018	0.9388	(94)
Useful gains	552.0508	575.0551	571.8260	542.1547	455.3771	306.2938	172.2309	179.2714	345.7469	465.4565	513.2800	532.0512	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1128.4483	1093.2578	968.8843	786.9491	559.6542	326.1768	174.5487	182.0852	387.3060	654.7491	908.1026	1115.3386	(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													
	428.8397	348.2322	295.4114	176.2519	77.5822	0.0000	0.0000	0.0000	0.0000	140.8337	284.2723	433.9658	(98)
Space heating												2185.3893	(98)
RHI space heating demand												2185	(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	35.1700	(1b)	x 2.4500	(2b) =	86.1665	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6900	(2c) =	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.7738	(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) =	0.1660	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4165	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3852	(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	0.4912	0.4815	0.4719	0.4237	0.4141	0.3660	0.3660	0.3563	0.3852	0.4141	0.4334	0.4526	(22b)
Effective ac	0.6206	0.6159	0.6113	0.5898	0.5857	0.5670	0.5670	0.5635	0.5742	0.5857	0.5939	0.6024	(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	
Windows (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Solid Door			4.3300	1.0000	4.3200			(26)
Flr - Ground			35.1700	0.1600	5.6272	75.6000	2658.8520	(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.2400	18.1980	38.9400	2952.6255	(29a)
Rf - Ins Joist	35.1700		35.1700	0.1100	3.8687	5.8200	204.6894	(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1275			(33)
Party Wall			40.3070	0.0000	0.0000	54.0300	2177.7872	(32)
Ground Floor Stud			74.5285			5.8200	433.7558	(32c)
1st Floor Stud			73.1348			5.8200	425.6443	(32c)
Internal Floor			35.1700			18.0000	633.0600	(32d)
Internal Ceiling			35.1700			5.8200	204.6894	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9691.1037 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		137.7751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8142 (36)
Total fabric heat loss	(33) + (36) =	48.9417 (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	37.0231	36.7437	36.4698	35.1834	34.9428	33.8224	33.8224	33.6149	34.2539	34.9428	35.4296	35.9387	(38)
Heat transfer coeff	85.9648	85.6854	85.4115	84.1252	83.8845	82.7641	82.7641	82.5566	83.1956	83.8845	84.3714	84.8804	(39)
Average = Sum(39)m / 12 =												84.1240	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2221	1.2182	1.2143	1.1960	1.1926	1.1766	1.1766	1.1737	1.1828	1.1926	1.1995	1.2067	(40)
HLP (average)												1.1960	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6313	13.1904	14.5637	14.0488	14.4843	13.9792	14.4216	14.4622	14.0171	14.5309	14.1144	14.6183	(61)
Total heat required for water heating calculated for each month	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(64)
Total per year (kWh/year) = Sum(64)m =												1551.5673	(64)
Heat gains from water heating, kWh/month	51.2482	44.9204	46.5919	40.9579	39.5511	34.4997	32.3360	36.5844	36.8668	42.5136	45.9701	49.7433	(65)

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

Metabolic gains (Table 5), Watts

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
(66)m	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1569	46.3253	37.6742	28.5218	21.3204	17.9996	19.4492	25.2808	33.9318	43.0842	50.2857	53.6065	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	68.8820	66.8458	62.6236	56.8860	53.1601	47.9163	43.4624	49.1725	51.2039	57.1419	63.8474	66.8592	(72)
Total internal gains	515.5620	510.7622	490.1577	458.8089	427.1053	399.0138	382.9644	391.4382	409.8518	441.4010	476.0842	501.9437	(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	Ref
North	2.8480	10.6334	0.7600	0.7200	0.7700	11.4839	(74)
South	3.2700	46.7521	0.7600	0.7200	0.7700	57.9733	(78)

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Solar gains	69.4572	116.8917	158.2358	196.5934	223.1341	223.4643	214.5863	194.0562	171.1772	128.5317	82.8850	59.6678	(83)
Total gains	585.0192	627.6539	648.3935	655.4023	650.2394	622.4781	597.5507	585.4944	581.0290	569.9327	558.9693	561.6116	(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)

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
tau	31.3148	31.4169	31.5177	31.9996	32.0914	32.5259	32.5259	32.6076	32.3571	32.0914	31.9062	31.7149	
alpha	3.0877	3.0945	3.1012	3.1333	3.1394	3.1684	3.1684	3.1738	3.1571	3.1394	3.1271	3.1143	
util living area	0.9620	0.9504	0.9311	0.8930	0.8225	0.6956	0.5527	0.5796	0.7548	0.8900	0.9459	0.9660	(86)
MIT	19.2296	19.4100	19.7097	20.1161	20.4983	20.8014	20.9303	20.9169	20.7222	20.2533	19.6854	19.2003	(87)
Th 2	19.9023	19.9055	19.9086	19.9232	19.9260	19.9387	19.9387	19.9411	19.9338	19.9260	19.9204	19.9146	(88)
util rest of house	0.9550	0.9412	0.9177	0.8702	0.7804	0.6184	0.4399	0.4701	0.6873	0.8625	0.9344	0.9597	(89)
MIT 2	18.3150	18.4943	18.7901	19.1939	19.5526	19.8218	19.9111	19.9060	19.7575	19.3314	18.7786	18.2955	(90)
Living area fraction										fLA = Living area / (4) =		0.2273	(91)
MIT	18.5229	18.7025	18.9992	19.4035	19.7676	20.0445	20.1428	20.1358	19.9768	19.5410	18.9848	18.5012	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3729	18.5525	18.8492	19.2535	19.6176	19.8945	19.9928	19.9858	19.8268	19.3910	18.8348	18.3512	(93)

8. Space heating requirement

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Utilisation	0.9422	0.9268	0.9014	0.8531	0.7664	0.6148	0.4461	0.4751	0.6796	0.8457	0.9195	0.9478	(94)
Useful gains	551.2292	581.6992	584.4594	559.1391	498.3396	382.6899	266.5915	278.1935	394.8552	482.0202	513.9905	532.3075	(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	1209.7775	1169.8177	1054.7628	870.9926	664.1640	438.1940	280.8036	296.0309	476.4445	737.4248	990.0794	1201.1555	(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	489.9599	395.2157	349.9057	224.5345	123.3734	0.0000	0.0000	0.0000	0.0000	190.0211	342.7840	497.6229	(98)
Space heating												2613.4171	(98)
Space heating per m2											(98) / (4) =	37.1541	(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	2887.7537	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	489.9599	395.2157	349.9057	224.5345	123.3734	0.0000	0.0000	0.0000	0.0000	190.0211	342.7840	497.6229	(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)													
	541.3921	436.7024	386.6362	248.1044	136.3242	0.0000	0.0000	0.0000	0.0000	209.9680	378.7669	549.8596	(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													
	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6992	89.6478	89.5443	89.3192	88.8766	87.3000	87.3000	87.3000	87.3000	89.1635	89.5398	89.7257	(217)
Fuel for water heating, kWh/month													
	175.8769	154.3503	160.5236	141.8145	137.8818	122.8260	115.4977	130.1450	130.9916	147.4435	158.3184	170.7771	(219)
Water heating fuel used												1746.4464	(219)
Annual totals kWh/year													
Space heating fuel - main system												2887.7537	(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)												368.4427	(232)
Total delivered energy for all uses												5077.6429	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2887.7537	3.4800	100.4938	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1746.4464	3.4800	60.7763	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	368.4427	13.1900	48.5976	(250)
Additional standing charges			120.0000	(251)
Total energy cost			339.7603	(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] =	1.2372	(257)
SAP value		82.7410	
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	2887.7537	0.2160	623.7548	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1746.4464	0.2160	377.2324	(264)
Space and water heating			1000.9872	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	368.4427	0.5190	191.2218	(268)
Total kg/year			1231.1340	(272)
CO2 emissions per m2			17.5000	(273)
EI value			85.6969	
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 / 0.8873 = 3.922, stars = 4
Water heating environmental impact	0.216 / 0.8873 = 0.2434, 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	35.1700	(1b)	x 2.4500	(2b) =	86.1665	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6900	(2c) =	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.7738	(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) =	0.1660	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4165	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3852	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.4045	0.3852	0.3852	0.3563	0.3563	0.3178	0.3274	0.3082	0.3178	0.3371	0.3371	0.3660	(22b)
Effective ac	0.5818	0.5742	0.5742	0.5635	0.5635	0.5505	0.5536	0.5475	0.5505	0.5568	0.5568	0.5670	(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	
Windows (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Solid Door			4.3300	1.0000	4.3200			(26)
Flr - Ground			35.1700	0.1600	5.6272	75.6000	2658.8520	(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.2400	18.1980	38.9400	2952.6255	(29a)
Rf - Ins Joist	35.1700		35.1700	0.1100	3.8687	5.8200	204.6894	(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1275			(33)
Party Wall			40.3070	0.0000	0.0000	54.0300	2177.7872	(32)
Ground Floor Stud			74.5285			5.8200	433.7558	(32c)
1st Floor Stud			73.1348			5.8200	425.6443	(32c)
Internal Floor			35.1700			18.0000	633.0600	(32d)
Internal Ceiling			35.1700			5.8200	204.6894	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9691.1037 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		137.7751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8142 (36)
Total fabric heat loss	(33) + (36) =	48.9417 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.7076	34.2539	34.2539	33.6149	33.6149	32.8403	33.0256	32.6605	32.8403	33.2165	33.2165	33.8224	(38)
Heat transfer coeff	83.6493	83.1956	83.1956	82.5566	82.5566	81.7820	81.9674	81.6022	81.7820	82.1582	82.1582	82.7641	(39)
Average = Sum(39)m / 12 =												82.4473	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1892	1.1828	1.1828	1.1737	1.1737	1.1627	1.1653	1.1601	1.1627	1.1680	1.1680	1.1766	(40)
HLP (average)												1.1721	(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		2.2544 (42)
Average daily hot water use (litres/day)		87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

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

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

	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6313	13.1904	14.5637	14.0488	14.4843	13.9792	14.4216	14.4622	14.0171	14.5309	14.1144	14.6183 (61)

Total heat required for water heating calculated for each month

	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309 (64)

Total per year (kWh/year) = Sum(64)m = 1551.5673 (64)

Heat gains from water heating, kWh/month

	51.2482	44.9204	46.5919	40.9579	39.5511	34.4997	32.3360	36.5844	36.8668	42.5136	45.9701	49.7433 (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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)

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

	52.1569	46.3253	37.6742	28.5218	21.3204	17.9996	19.4492	25.2808	33.9318	43.0842	50.2857	53.6065 (67)

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

	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)

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

	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)

	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)

Water heating gains (Table 5)

	68.8820	66.8458	62.6236	56.8860	53.1601	47.9163	43.4624	49.1725	51.2039	57.1419	63.8474	66.8592 (72)

Total internal gains

	515.5620	510.7622	490.1577	458.8089	427.1053	399.0138	382.9644	391.4382	409.8518	441.4010	476.0842	501.9437 (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	2.8480	11.9814	0.7600	0.7200	0.7700	12.9398	(74)
South	3.2700	50.9848	0.7600	0.7200	0.7700	63.2220	(78)

Solar gains	76.1618	115.3718	154.8040	199.7274	222.4125	239.0847	226.8163	208.5679	182.0098	135.5597	93.1047	64.8060 (83)
Total gains	591.7238	626.1340	644.9617	658.5364	649.5178	638.0985	609.7807	600.0061	591.8616	576.9607	569.1890	566.7498 (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	32.1816	32.3571	32.3571	32.6076	32.6076	32.9164	32.8420	32.9890	32.9164	32.7657	32.7657	32.5259	
alpha	3.1454	3.1571	3.1571	3.1738	3.1738	3.1944	3.1895	3.1993	3.1944	3.1844	3.1844	3.1684	

util living area

	0.9550	0.9438	0.9193	0.8682	0.7667	0.5751	0.4014	0.4175	0.6717	0.8582	0.9322	0.9593 (86)

MIT	19.4342	19.5845	19.8956	20.2915	20.6660	20.9135	20.9808	20.9781	20.8417	20.4293	19.8933	19.4136 (87)
Th 2	19.9286	19.9338	19.9338	19.9411	19.9411	19.9500	19.9479	19.9520	19.9500	19.9457	19.9457	19.9387 (88)

util rest of house

	0.9465	0.9333	0.9032	0.8396	0.7108	0.4761	0.2720	0.2886	0.5855	0.8221	0.9174	0.9516 (89)
MIT 2	18.5361	18.6867	18.9900	19.3736	19.7122	19.9103	19.9437	19.9470	19.8635	19.5105	19.0000	18.5238 (90)

Living area fraction fLA = Living area / (4) = 0.2273 (91)

MIT	18.7402	18.8908	19.1959	19.5822	19.9290	20.1384	20.1795	20.1814	20.0858	19.7194	19.2031	18.7261 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5902	18.7408	19.0459	19.4322	19.7790	19.9884	20.0295	20.0314	19.9358	19.5694	19.0531	18.5761 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9330	0.9184	0.8866	0.8233	0.7011	0.4800	0.2824	0.2988	0.5842	0.8067	0.9018	0.9388	(94)
Useful gains	552.0508	575.0551	571.8260	542.1547	455.3771	306.2938	172.2309	179.2714	345.7469	465.4565	513.2800	532.0512	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)

Heat loss rate W

	1128.4483	1093.2578	968.8843	786.9491	559.6542	326.1768	174.5487	182.0852	387.3060	654.7491	908.1026	1115.3386	(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

	428.8397	348.2322	295.4114	176.2519	77.5822	0.0000	0.0000	0.0000	0.0000	140.8337	284.2723	433.9658	(98)

Space heating 2185.3893 (98)

Space heating per m2 (98) / (4) = 31.0689 (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	2414.7948	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	428.8397	348.2322	295.4114	176.2519	77.5822	0.0000	0.0000	0.0000	0.0000	140.8337	284.2723	433.9658	(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)													
	473.8560	384.7870	326.4214	194.7535	85.7262	0.0000	0.0000	0.0000	0.0000	155.6173	314.1130	479.5203	(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													
	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6166	89.5664	89.4271	89.1338	88.5133	87.3000	87.3000	87.3000	87.3000	88.9263	89.4095	89.6425	(217)
Fuel for water heating, kWh/month													
	176.0391	154.4907	160.7340	142.1095	138.4477	122.8260	115.4977	130.1450	130.9916	147.8368	158.5492	170.9355	(219)
Water heating fuel used												1748.6026	(219)
Annual totals kWh/year													
Space heating fuel - main system												2414.7948	(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)												368.4427	(232)
Total delivered energy for all uses												4606.8400	(238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2414.7948	3.6300	87.6570	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1748.6026	3.6300	63.4743	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	368.4427	19.4400	71.6253	(250)
Additional standing charges			95.0000	(251)
Total energy cost			332.3366	(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	2414.7948	0.2160	521.5957	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1748.6026	0.2160	377.6982	(264)
Space and water heating			899.2938	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	368.4427	0.5190	191.2218	(268)
Total kg/year			1129.4406	(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	2414.7948	1.2200	2946.0496	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1748.6026	1.2200	2133.2952	(264)
Space and water heating			5079.3448	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	368.4427	3.0700	1131.1191	(268)
Primary energy kWh/year			6440.7138	(272)
Primary energy kWh/m2/year			91.5655	(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	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Recommended
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 24	-175 kg (15.5%)
U Solar photovoltaic panels	+ 11.6	-£ 355	-947 kg (99.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£24	2.49 kg/m²	B 84	B 88
Solar photovoltaic panels	£355	13.46 kg/m²	A 96	A 98
Total Savings	£379	15.95 kg/m²		

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

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£86	£96	-£10
Mains gas	£246	£212	£34
Space heating	£197	£197	£0
Water heating	£63	£39	£24
Lighting	£72	£72	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£332	-£47	£379
Total cost of uses	£332	-£47	£379
Delivered energy	65 kWh/m²	27 kWh/m²	38 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	16 kg/m²	0 kg/m²	16 kg/m²
Primary energy	92 kWh/m²	-2 kWh/m²	94 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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700	(1b)	x 2.4500	(2b) =	86.1665	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6900	(2c) =	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.7738	(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) =	0.1660	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4165	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3852	(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	0.4912	0.4815	0.4719	0.4237	0.4141	0.3660	0.3660	0.3563	0.3852	0.4141	0.4334	0.4526	(22b)
Effective ac	0.6206	0.6159	0.6113	0.5898	0.5857	0.5670	0.5670	0.5635	0.5742	0.5857	0.5939	0.6024	(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	
Windows (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Solid Door			4.3300	1.0000	4.3200			(26)
Flr - Ground			35.1700	0.1600	5.6272	75.6000	2658.8520	(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.2400	18.1980	38.9400	2952.6255	(29a)
Rf - Ins Joist	35.1700		35.1700	0.1100	3.8687	5.8200	204.6894	(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1275			(33)
Party Wall			40.3070	0.0000	0.0000	54.0300	2177.7872	(32)
Ground Floor Stud			74.5285			5.8200	433.7558	(32c)
1st Floor Stud			73.1348			5.8200	425.6443	(32c)
Internal Floor			35.1700			18.0000	633.0600	(32d)
Internal Ceiling			35.1700			5.8200	204.6894	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9691.1037 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		137.7751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8142 (36)
Total fabric heat loss	(33) + (36) =	48.9417 (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	37.0231	36.7437	36.4698	35.1834	34.9428	33.8224	33.8224	33.6149	34.2539	34.9428	35.4296	35.9387	(38)
Heat transfer coeff	85.9648	85.6854	85.4115	84.1252	83.8845	82.7641	82.7641	82.5566	83.1956	83.8845	84.3714	84.8804	(39)
Average = Sum(39)m / 12 =												84.1240	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2221	1.2182	1.2143	1.1960	1.1926	1.1766	1.1766	1.1737	1.1828	1.1926	1.1995	1.2067	(40)
HLP (average)												1.1960	(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	2.2544 (42)
Average daily hot water use (litres/day)	87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m													
	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6313	13.1904	14.5637	14.0488	14.4843	13.9792	14.4216	14.4622	14.0171	14.5309	14.1144	14.6183	(61)
Total heat required for water heating calculated for each month													
	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309	(62)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0050	(H3a)
Collector effective heat loss coefficient	1.8063	(H3b)
Collector performance ratio	2.5804	(H4)
Annual solar radiation per m2	1079.5246	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1813.6014	(H7)
Adjustment factor for showers	1.0000	(H7a)
Solar-to-load ratio	1.3137	(H8)
Utilisation factor	0.5329	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	87.7408	(H14)
Volume ratio Veff/V	0.8548	(H15)
Solar storage volume factor	0.9686	(H16)
Solar input	-823.1303	(H17)

Solar input	-23.8691	-39.8307	-67.8363	-90.9140	-112.3166	-110.4251	-108.9658	-95.2040	-74.5638	-50.9183	-28.3122	-19.9744	(63)
								Solar input (sum of months) = Sum(63)m =				-823.1303	(63)
Output from w/h													
	133.8910	98.5410	75.9034	35.7536	10.2281	0.0000	0.0000	18.4126	39.7919	80.5474	113.4458	133.2565	(64)
								Total per year (kWh/year) = Sum(64)m =				739.7713	(64)
Heat gains from water heating, kWh/month													
	51.2482	44.9204	46.5919	40.9579	39.5511	34.4997	32.3360	36.5844	36.8668	42.5136	45.9701	49.7433	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.1569	46.3253	37.6742	28.5218	21.3204	17.9996	19.4492	25.2808	33.9318	43.0842	50.2857	53.6065	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)													
	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
	68.8820	66.8458	62.6236	56.8860	53.1601	47.9163	43.4624	49.1725	51.2039	57.1419	63.8474	66.8592	(72)
Total internal gains													
	515.5620	510.7622	490.1577	458.8089	427.1053	399.0138	382.9644	391.4382	409.8518	441.4010	476.0842	501.9437	(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	2.8480	10.6334	0.7600	0.7200	0.7700	11.4839	(74)
South	3.2700	46.7521	0.7600	0.7200	0.7700	57.9733	(78)

Solar gains	69.4572	116.8917	158.2358	196.5934	223.1341	223.4643	214.5863	194.0562	171.1772	128.5317	82.8850	59.6678	(83)
Total gains	585.0192	627.6539	648.3935	655.4023	650.2394	622.4781	597.5507	585.4944	581.0290	569.9327	558.9693	561.6116	(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	31.3148	31.4169	31.5177	31.9996	32.0914	32.5259	32.5259	32.6076	32.3571	32.0914	31.9062	31.7149	
alpha	3.0877	3.0945	3.1012	3.1333	3.1394	3.1684	3.1684	3.1738	3.1571	3.1394	3.1271	3.1143	
util living area													
	0.9620	0.9504	0.9311	0.8930	0.8225	0.6956	0.5527	0.5796	0.7548	0.8900	0.9459	0.9660	(86)
MIT	19.2296	19.4100	19.7097	20.1161	20.4983	20.8014	20.9303	20.9169	20.7222	20.2533	19.6854	19.2003	(87)
Th 2	19.9023	19.9055	19.9086	19.9232	19.9260	19.9387	19.9387	19.9411	19.9338	19.9260	19.9204	19.9146	(88)
util rest of house													
	0.9550	0.9412	0.9177	0.8702	0.7804	0.6184	0.4399	0.4701	0.6873	0.8625	0.9344	0.9597	(89)
MIT 2	18.3150	18.4943	18.7901	19.1939	19.5526	19.8218	19.9111	19.9060	19.7575	19.3314	18.7786	18.2955	(90)
Living area fraction									fLA = Living area / (4) =			0.2273	(91)
MIT	18.5229	18.7025	18.9992	19.4035	19.7676	20.0445	20.1428	20.1358	19.9768	19.5410	18.9848	18.5012	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3729	18.5525	18.8492	19.2535	19.6176	19.8945	19.9928	19.9858	19.8268	19.3910	18.8348	18.3512	(93)

8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9422	0.9268	0.9014	0.8531	0.7664	0.6148	0.4461	0.4751	0.6796	0.8457	0.9195	0.9478	(94)
Useful gains	551.2292	581.6992	584.4594	559.1391	498.3396	382.6899	266.5915	278.1935	394.8552	482.0202	513.9905	532.3075	(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	1209.7775	1169.8177	1054.7628	870.9926	664.1640	438.1940	280.8036	296.0309	476.4445	737.4248	990.0794	1201.1555	(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	489.9599	395.2157	349.9057	224.5345	123.3734	0.0000	0.0000	0.0000	0.0000	190.0211	342.7840	497.6229	(98)
Space heating												2613.4171	(98)
Space heating per m2											(98) / (4) =	37.1541	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2887.7537	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	489.9599	395.2157	349.9057	224.5345	123.3734	0.0000	0.0000	0.0000	0.0000	190.0211	342.7840	497.6229	(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)	541.3921	436.7024	386.6362	248.1044	136.3242	0.0000	0.0000	0.0000	0.0000	209.9680	378.7669	549.8596	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8910	98.5410	75.9034	35.7536	10.2281	0.0000	0.0000	18.4126	39.7919	80.5474	113.4458	133.2565	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7936	89.8428	89.9125	90.0466	90.2467	87.3000	87.3000	87.3000	87.3000	89.5231	89.6826	89.8047	(217)
Fuel for water heating, kWh/month	149.1098	109.6816	84.4192	39.7056	11.3335	0.0000	0.0000	21.0912	45.5806	89.9739	126.4970	148.3848	(219)
Water heating fuel used												825.7771	(219)

Annual totals kWh/year

Space heating fuel - main system	2887.7537	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	125.0000	(231)
Electricity for lighting (calculated in Appendix L)	368.4427	(232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =	-1727.2394	-1727.2394	(233)
Total delivered energy for all uses		2479.7342	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2887.7537	3.4800	100.4938	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	825.7771	3.4800	28.7370	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	368.4427	13.1900	48.5976	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			86.4931	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.3150	(257)
SAP value	95.6064	
SAP rating (Section 12)	96	(258)
SAP band	A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2887.7537	0.2160	623.7548 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	825.7771	0.2160	178.3679 (264)
Space and water heating			802.1227 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	368.4427	0.5190	191.2218 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			161.7822 (272)
CO2 emissions per m2			2.3000 (273)
EI value			98.1204
EI rating			98 (274)
EI band			A

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.1700	(1b)	x 2.4500	(2b) =	86.1665	(1b) - (3b)
First floor	35.1700	(1c)	x 2.6900	(2c) =	94.6073	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.7738	(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) =	0.1660	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4165	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3852	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.4045	0.3852	0.3852	0.3563	0.3563	0.3178	0.3274	0.3082	0.3178	0.3371	0.3371	0.3660	(22b)
Effective ac	0.5818	0.5742	0.5742	0.5635	0.5635	0.5505	0.5536	0.5475	0.5505	0.5568	0.5568	0.5670	(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	
Windows (Uw = 1.40)			6.1200	1.3258	8.1136			(27)
Solid Door			4.3300	1.0000	4.3200			(26)
Flr - Ground			35.1700	0.1600	5.6272	75.6000	2658.8520	(28a)
Wl - Brick	86.2690	10.4440	75.8250	0.2400	18.1980	38.9400	2952.6255	(29a)
Rf - Ins Joist	35.1700		35.1700	0.1100	3.8687	5.8200	204.6894	(30)
Total net area of external elements Aum(A, m2)			156.6050					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.1275			(33)
Party Wall			40.3070	0.0000	0.0000	54.0300	2177.7872	(32)
Ground Floor Stud			74.5285			5.8200	433.7558	(32c)
1st Floor Stud			73.1348			5.8200	425.6443	(32c)
Internal Floor			35.1700			18.0000	633.0600	(32d)
Internal Ceiling			35.1700			5.8200	204.6894	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9691.1037 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		137.7751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8142 (36)
Total fabric heat loss	(33) + (36) =	48.9417 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.7076	34.2539	34.2539	33.6149	33.6149	32.8403	33.0256	32.6605	32.8403	33.2165	33.2165	33.8224	(38)
Heat transfer coeff	83.6493	83.1956	83.1956	82.5566	82.5566	81.7820	81.9674	81.6022	81.7820	82.1582	82.1582	82.7641	(39)
Average = Sum(39)m / 12 =												82.4473	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1892	1.1828	1.1828	1.1737	1.1737	1.1627	1.1653	1.1601	1.1627	1.1680	1.1680	1.1766	(40)
HLP (average)												1.1721	(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	2.2544 (42)
Average daily hot water use (litres/day)	87.7408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149	(44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126	(45)
Energy content (annual)										Total = Sum(45)m =		1380.5050	(45)

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

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

	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6313	13.1904	14.5637	14.0488	14.4843	13.9792	14.4216	14.4622	14.0171	14.5309	14.1144	14.6183 (61)

Total heat required for water heating calculated for each month

	157.7602	138.3718	143.7397	126.6676	122.5447	107.2271	100.8295	113.6165	114.3556	131.4657	141.7580	153.2309 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1140.0998 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1915.3676 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3874 (H8)
Utilisation factor	0.5136 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	87.7408 (H14)
Volume ratio Veff/V	0.8548 (H15)
Solar storage volume factor	0.9686 (H16)
Solar input	-837.8688 (H17)

Solar input	-25.7892	-38.7611	-65.2786	-90.2350	-108.6733	-114.3739	-111.6275	-99.6841	-77.8038	-52.9285	-31.3474	-21.3665 (63)

Solar input (sum of months) = Sum(63)m = -837.8688 (63)

Output from w/h

	131.9710	99.6107	78.4611	36.4326	13.8714	0.0000	0.0000	13.9325	36.5519	78.5373	110.4106	131.8644 (64)

Total per year (kWh/year) = Sum(64)m = 731.6433 (64)

Heat gains from water heating, kWh/month

	51.2482	44.9204	46.5919	40.9579	39.5511	34.4997	32.3360	36.5844	36.8668	42.5136	45.9701	49.7433 (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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)

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

	52.1569	46.3253	37.6742	28.5218	21.3204	17.9996	19.4492	25.2808	33.9318	43.0842	50.2857	53.6065 (67)

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

	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)

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

	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)

	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)

Water heating gains (Table 5)

	68.8820	66.8458	62.6236	56.8860	53.1601	47.9163	43.4624	49.1725	51.2039	57.1419	63.8474	66.8592 (72)

Total internal gains

	515.5620	510.7622	490.1577	458.8089	427.1053	399.0138	382.9644	391.4382	409.8518	441.4010	476.0842	501.9437 (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	2.8480	11.9814	0.7600	0.7200	0.7700	12.9398	(74)
South	3.2700	50.9848	0.7600	0.7200	0.7700	63.2220	(78)

Solar gains	76.1618	115.3718	154.8040	199.7274	222.4125	239.0847	226.8163	208.5679	182.0098	135.5597	93.1047	64.8060 (83)
Total gains	591.7238	626.1340	644.9617	658.5364	649.5178	638.0985	609.7807	600.0061	591.8616	576.9607	569.1890	566.7498 (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	32.1816	32.3571	32.3571	32.6076	32.6076	32.9164	32.8420	32.9890	32.9164	32.7657	32.7657	32.5259	
alpha	3.1454	3.1571	3.1571	3.1738	3.1738	3.1944	3.1895	3.1993	3.1944	3.1844	3.1844	3.1684	
util living area	0.9550	0.9438	0.9193	0.8682	0.7667	0.5751	0.4014	0.4175	0.6717	0.8582	0.9322	0.9593	(86)
MIT	19.4342	19.5845	19.8956	20.2915	20.6660	20.9135	20.9808	20.9781	20.8417	20.4293	19.8933	19.4136	(87)
Th 2	19.9286	19.9338	19.9338	19.9411	19.9411	19.9500	19.9479	19.9520	19.9500	19.9457	19.9457	19.9387	(88)
util rest of house	0.9465	0.9333	0.9032	0.8396	0.7108	0.4761	0.2720	0.2886	0.5855	0.8221	0.9174	0.9516	(89)
MIT 2	18.5361	18.6867	18.9900	19.3736	19.7122	19.9103	19.9437	19.9470	19.8635	19.5105	19.0000	18.5238	(90)
Living area fraction									fLA = Living area / (4) =			0.2273	(91)
MIT	18.7402	18.8908	19.1959	19.5822	19.9290	20.1384	20.1795	20.1814	20.0858	19.7194	19.2031	18.7261	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5902	18.7408	19.0459	19.4322	19.7790	19.9884	20.0295	20.0314	19.9358	19.5694	19.0531	18.5761	(93)

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8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9330	0.9184	0.8866	0.8233	0.7011	0.4800	0.2824	0.2988	0.5842	0.8067	0.9018	0.9388	(94)
Useful gains	552.0508	575.0551	571.8260	542.1547	455.3771	306.2938	172.2309	179.2714	345.7469	465.4565	513.2800	532.0512	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1128.4483	1093.2578	968.8843	786.9491	559.6542	326.1768	174.5487	182.0852	387.3060	654.7491	908.1026	1115.3386	(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	428.8397	348.2322	295.4114	176.2519	77.5822	0.0000	0.0000	0.0000	0.0000	140.8337	284.2723	433.9658	(98)
Space heating												2185.3893	(98)
Space heating per m2											(98) / (4) =	31.0689	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2414.7948	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	428.8397	348.2322	295.4114	176.2519	77.5822	0.0000	0.0000	0.0000	0.0000	140.8337	284.2723	433.9658	(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)	473.8560	384.7870	326.4214	194.7535	85.7262	0.0000	0.0000	0.0000	0.0000	155.6173	314.1130	479.5203	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	131.9710	99.6107	78.4611	36.4326	13.8714	0.0000	0.0000	13.9325	36.5519	78.5373	110.4106	131.8644	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7260	89.7681	89.8091	89.9353	89.9996	87.3000	87.3000	87.3000	87.3000	89.3278	89.5814	89.7335	(217)
Fuel for water heating, kWh/month	147.0821	110.9644	87.3643	40.5098	15.4127	0.0000	0.0000	15.9593	41.8693	87.9204	123.2516	146.9512	(219)
Water heating fuel used												817.2851	(219)
Annual totals kWh/year													
Space heating fuel - main system												2414.7948	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												368.4427	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)
Total delivered energy for all uses												1901.3629	(238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2414.7948	3.6300	87.6570	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	817.2851	3.6300	29.6674	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	368.4427	19.4400	71.6253	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	19.4400	-354.6166	(252)
Total energy cost			-46.3669	(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	2414.7948	0.2160	521.5957	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	817.2851	0.2160	176.5336	(264)
Space and water heating			698.1292	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	368.4427	0.5190	191.2218	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			7.4872	(272)

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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2414.7948	1.2200	2946.0496	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	817.2851	1.2200	997.0878	(264)
Space and water heating			3943.1374	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	368.4427	3.0700	1131.1191	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	3.0700	-5600.1701	(269)
Primary energy kWh/year			-142.1636	(272)
Primary energy kWh/m2/year			-2.0211	(273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	137.8 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.55 (Calculated rate)

Overheating Calculation

Summer ventilation heat loss coefficient	271.48 (P1)
Transmission heat loss coefficient	48.94 (37)
Summer heat loss coefficient	320.42 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.8480	81.1852	0.7600	0.7200	0.7650	87.1097
South	3.2700	112.2060	0.7600	0.7200	0.7650	138.2337
total:						225.3434

	Jun	Jul	Aug	
Solar gains	238	225	207	(P3)
Internal gains	396	380	388	
Total summer gains	634	605	596	(P5)
Summer gain/loss ratio	1.98	1.89	1.86	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 137.8)	1.04	1.04	1.04	
Threshold temperature	19.01	20.82	20.69	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	224	**Issued on Date**	16/05/2022
Assessment Reference	224 S	**Prop Type Ref**	2B3P
Property	Plot 224		

SAP Rating	83 B	**DER**	19.38	**TER**	20.01
Environmental	86 B	**% DER<TER**	3.13		
CO_2 Emissions (t/year)	1.13	**DFEE**	48.62	**TFEE**	54.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.97		

Assessor Details	Chris Nicholls, , Tel: ,	**Assessor ID**	U903-0001
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)	20.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	19.38	$kgCO_2/m^2$	Pass
	-0.63 (-3.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.61	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.62	$kWh/m^2/yr$	
	-6.0 (-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	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.23 (max. 2.00)	1.40 (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 30 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 (Thames Valley)	Slight	Pass

Based on:

Overshading	Average
Windows facing North	2.85 m², No overhang
Windows facing South	3.27 m², No overhang
Air change rate	4.55 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		
Filled Cavity with Edge Sealing	0.00	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
Door U-value	1.00	W/m²K