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

ENVIRONMENTAL ECONOMICS

Property Reference	Plot 107 SH56-E-7 ET	**Issued on Date**	10/08/2022
Assessment Reference	001	**Prop Type Ref**	
Property	Plot 107, Forest Walk Parcel 8, Whitely, SO30		

SAP Rating	85 B	**DER**	15.82	**TER**	17.25
Environmental	87 B	**% DER<TER**	8.28		
CO_2 Emissions (t/year)	1.29	**DFEE**	43.50	**TFEE**	49.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.62		

Assessor Details	Ms. Hazel Black, Hazel Black, Tel: 01582 544250, hazelb@ee-ltd.co.uk	**Assessor ID**	M003-0001
Client			

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 101 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.25 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.82 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (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 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.32 m², No overhang
Windows facing East: 2.94 m², No overhang
Windows facing West: 2.86 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
External wall U-value 0.12 W/m²K
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.033 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.9600 (1b)	x	2.3100 (2b)	=	89.9976	(1b) - (3b)
First floor	38.9600 (1c)	x	2.5600 (2c)	=	99.7376	(1c) - (3c)
Second floor	23.3600 (1d)	x	2.3100 (2d)	=	53.9616	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.6968	(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) =	0.1231	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.3736	(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) =		0.3456	(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	0.4406	0.4320	0.4233	0.3801	0.3715	0.3283	0.3283	0.3197	0.3456	0.3715	0.3888	0.4061	(22b)
Effective ac	0.5971	0.5933	0.5896	0.5723	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5756	0.5824	(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	
Entrance Door			2.1300	1.0000	2.1300			(26)
Window (Uw = 1.41)			7.1200	1.3347	9.5032			(27)
Roof Light (Uw = 1.50)			1.3500	1.4151	1.9104			(27a)
150mm B&B			38.9600	0.1400	5.4544			(28a)
50mm Alreflex Plat	86.5200	9.2500	77.2700	0.2700	20.8629			(29a)
Timber Walls to Roofspace	21.2400		21.2400	0.1200	2.5488			(29a)
Gable End	15.7800		15.7800	0.2200	3.4716			(29a)
Horizontal Ceiling	11.9400		11.9400	0.1400	1.6716			(30)
Sloping Ceilings	14.4400	1.3500	13.0900	0.1600	2.0944			(30)
1st Floor to Roofspace	15.2900		15.2900	0.1200	1.8348			(30)
Total net area of external elements Aum(A, m2)			204.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4821			(33)
E-WM-22			38.4200	0.0000	0.0000			(32)
Party Gable			15.7800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	138.8000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6979	(36)
Total fabric heat loss (33) + (36) =	58.1800	(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	48.0165	47.7134	47.4163	46.0206	45.7595	44.5440	44.5440	44.3189	45.0122	45.7595	46.2877	46.8400	(38)
Heat transfer coeff	106.1965	105.8934	105.5963	104.2006	103.9395	102.7239	102.7239	102.4988	103.1922	103.9395	104.4677	105.0200	(39)
Average = Sum(39)m / 12 =												104.1994	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0485	1.0456	1.0426	1.0288	1.0263	1.0143	1.0143	1.0120	1.0189	1.0263	1.0315	1.0369	(40)
HLP (average)												1.0288	(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	2.7511 (42)
Average daily hot water use (litres/day)	99.5378 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.4915	105.5100	101.5285	97.5470	93.5655	89.5840	89.5840	93.5655	97.5470	101.5285	105.5100	109.4915	(44)

Energy conte	162.3728	142.0123	146.5439	127.7606	122.5893	105.7852	98.0256	112.4858	113.8292	132.6570	144.8055	157.2494	(45)
Energy content (annual)										Total = Sum(45)m =		1566.1164	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.3559	21.3018	21.9816	19.1641	18.3884	15.8678	14.7038	16.8729	17.0744	19.8985	21.7208	23.5874	(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	14.1463	12.7661	14.1083	13.6119	14.0318	13.5402	13.9673	14.0092	13.5793	14.0749	13.6603	14.1340	(61)
Total heat required for water heating calculated for each month													
	176.5190	154.7784	160.6522	141.3725	136.6211	119.3255	111.9929	126.4949	127.4085	146.7319	158.4658	171.3833	(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													
	176.5190	154.7784	160.6522	141.3725	136.6211	119.3255	111.9929	126.4949	127.4085	146.7319	158.4658	171.3833	(64)
									Total per year (kWh/year) = Sum(64)m =			1731.7460	(64)
Heat gains from water heating, kWh/month													
	57.5255	50.4106	52.2529	45.8834	44.2689	38.5587	36.0853	40.9038	41.2430	47.6272	51.5629	55.8189	(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	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4026	24.3388	19.7936	14.9850	11.2015	9.4568	10.2184	13.2822	17.8274	22.6360	26.4195	28.1642	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.3806	261.0618	254.3053	239.9215	221.7646	204.6996	193.2992	190.6180	197.3745	211.7583	229.9152	246.9802	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	(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)													
	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	(71)
Water heating gains (Table 5)													
	77.3192	75.0158	70.2324	63.7269	59.5012	53.5537	48.5018	54.9782	57.2820	64.0150	71.6151	75.0254	(72)
Total internal gains													
	430.3684	427.6823	411.5973	385.8994	359.7333	334.9760	319.2853	326.1444	339.7499	365.6752	395.2158	417.4358	(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	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	2.9400	19.6403	0.7100	0.7000	0.7700	19.8877	(76)
West	2.8600	19.6403	0.7100	0.7000	0.7700	19.3465	(80)
West	1.3500	26.4634	0.7100	0.7000	1.0000	15.9801	(82)

Solar gains	60.0486	118.1773	197.4475	294.0187	366.7505	378.5205	359.0826	303.9659	231.4657	140.8749	74.9751	49.3303	(83)
Total gains	490.4170	545.8596	609.0447	679.9181	726.4838	713.4965	678.3680	630.1104	571.2155	506.5501	470.1910	466.7660	(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	36.7706	36.8758	36.9796	37.4749	37.5690	38.0136	38.0136	38.0971	37.8411	37.5690	37.3791	37.1825	
alpha	3.4514	3.4584	3.4653	3.4983	3.5046	3.5342	3.5342	3.5398	3.5227	3.5046	3.4919	3.4788	
util living area													
	0.9914	0.9867	0.9749	0.9434	0.8738	0.7465	0.6034	0.6561	0.8558	0.9614	0.9867	0.9928	(86)
MIT	19.1049	19.2816	19.6177	20.0829	20.5084	20.8145	20.9365	20.9136	20.6686	20.1199	19.5381	19.0784	(87)
Th 2	20.0431	20.0455	20.0480	20.0594	20.0615	20.0715	20.0715	20.0733	20.0676	20.0615	20.0572	20.0527	(88)
util rest of house													
	0.9897	0.9840	0.9695	0.9302	0.8419	0.6789	0.4985	0.5545	0.8072	0.9501	0.9836	0.9913	(89)
MIT 2	17.4848	17.7436	18.2334	18.9093	19.5028	19.9023	20.0313	20.0143	19.7311	18.9717	18.1262	17.4519	(90)
Living area fraction									fLA = Living area / (4) =			0.1718	(91)
MIT	17.7631	18.0078	18.4712	19.1109	19.6756	20.0590	20.1869	20.1688	19.8922	19.1690	18.3688	17.7314	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.6131	17.8578	18.3212	18.9609	19.5256	19.9090	20.0369	20.0188	19.7422	19.0190	18.2188	17.5814	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9747	0.9556	0.9099	0.8197	0.6654	0.4943	0.5479	0.7863	0.9322	0.9743	0.9855	(94)
Useful gains	482.0523	532.0704	582.0061	618.6471	595.5254	474.7793	335.2919	345.2212	449.1306	472.2209	458.0859	459.9789	(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													
	1413.8081	1372.1466	1248.2780	1048.3553	813.3886	545.3652	353.0475	370.9190	582.2286	875.0655	1161.5541	1405.3113	(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													
	693.2263	564.5312	495.7063	309.3899	162.0902	0.0000	0.0000	0.0000	0.0000	299.7163	506.4971	703.3273	(98)
Space heating												3734.4846	(98)
Space heating per m2											(98) / (4) =	36.8729	(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	4126.5023	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	693.2263	564.5312	495.7063	309.3899	162.0902	0.0000	0.0000	0.0000	0.0000	299.7163	506.4971	703.3273	(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)													
	765.9959	623.7914	547.7417	341.8673	179.1052	0.0000	0.0000	0.0000	0.0000	331.1782	559.6653	777.1573	(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													
	176.5190	154.7784	160.6522	141.3725	136.6211	119.3255	111.9929	126.4949	127.4085	146.7319	158.4658	171.3833	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8317	89.7918	89.6953	89.4714	89.0078	87.3000	87.3000	87.3000	87.3000	89.4227	89.7163	89.8547	(217)
Fuel for water heating, kWh/month													
	196.4997	172.3748	179.1089	158.0085	153.4935	136.6844	128.2851	144.8968	145.9433	164.0880	176.6299	190.7339	(219)
Water heating fuel used												1946.7467	(219)
Annual totals kWh/year													
Space heating fuel - main system												4126.5023	(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)												483.9391	(232)
Total delivered energy for all uses												6632.1882	(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	4126.5023	0.2160	891.3245	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1946.7467	0.2160	420.4973	(264)
Space and water heating			1311.8218	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	483.9391	0.5190	251.1644	(268)
Total CO2, kg/year			1601.9112	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8200	(273)

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

DER		15.8200	ZC1
Total Floor Area	TFA	101.2800	
Assumed number of occupants	N	2.7511	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1176	ZC2
CO2 emissions from cooking, equation (L16)		1.8269	ZC3
Total CO2 emissions		32.7645	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		32.7645	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	38.9600 (1b)	x	2.3100 (2b)	=	89.9976	(1b) - (3b)
First floor	38.9600 (1c)	x	2.5600 (2c)	=	99.7376	(1c) - (3c)
Second floor	23.3600 (1d)	x	2.3100 (2d)	=	53.9616	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.6968	(5)

2. Ventilation rate

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

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/	(5) =	0.1641	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4141	(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) =			0.3831	(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	0.4884	0.4788	0.4693	0.4214	0.4118	0.3639	0.3639	0.3543	0.3831	0.4118	0.4310	0.4501	(22b)
Effective ac	0.6193	0.6146	0.6101	0.5888	0.5848	0.5662	0.5662	0.5628	0.5734	0.5848	0.5929	0.6013	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1300	1.0000	2.1300			(26)
TER Opening Type (Uw = 1.40)			7.1200	1.3258	9.4394			(27)
TER Room Window (Uw = 1.70)			1.3500	1.5918	2.1489			(27a)
150mm B&B			38.9600	0.1300	5.0648			(28a)
50mm Alreflex Plat	86.5200	9.2500	77.2700	0.1800	13.9086			(29a)
Timber Walls to Roofspace	21.2400		21.2400	0.1800	3.8232			(29a)
Gable End	15.7800		15.7800	0.1800	2.8404			(29a)
Horizontal Ceiling	11.9400		11.9400	0.1300	1.5522			(30)
Sloping Ceilings	14.4400	1.3500	13.0900	0.1300	1.7017			(30)
1st Floor to Roofspace	15.2900		15.2900	0.1300	1.9877			(30)
Total net area of external elements Aum(A, m2)			204.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.5969			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.3853 (36)
Total fabric heat loss	(33) + (36) =	53.9822 (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	49.8024	49.4299	49.0648	47.3499	47.0290	45.5354	45.5354	45.2588	46.1107	47.0290	47.6781	48.3567	(38)
Heat transfer coeff	103.7846	103.4121	103.0470	101.3321	101.0112	99.5176	99.5176	99.2410	100.0929	101.0112	101.6603	102.3389	(39)
Average = Sum(39)m / 12 =												101.3305	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0247	1.0211	1.0174	1.0005	0.9973	0.9826	0.9826	0.9799	0.9883	0.9973	1.0038	1.0105	(40)
HLP (average)												1.0005	(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		2.7511 (42)
Average daily hot water use (litres/day)		99.5378 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.4915	105.5100	101.5285	97.5470	93.5655	89.5840	89.5840	93.5655	97.5470	101.5285	105.5100	109.4915	(44)
Energy conte	162.3728	142.0123	146.5439	127.7606	122.5893	105.7852	98.0256	112.4858	113.8292	132.6570	144.8055	157.2494	(45)
Energy content (annual)										Total = Sum(45)m =		1566.1164	(45)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
               24.3559    21.3018    21.9816    19.1641    18.3884    15.8678    14.7038    16.8729    17.0744    19.8985    21.7208    23.5874 (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     50.9589    46.0274    50.9589    48.1054    47.6799    44.1784    45.6510    47.6799    48.1054    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
              213.3317   188.0397   197.5028   175.8659   170.2692   149.9636   143.6766   160.1657   161.9346   183.6159   194.1205   208.2083 (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
              213.3317   188.0397   197.5028   175.8659   170.2692   149.9636   143.6766   160.1657   161.9346   183.6159   194.1205   208.2083 (64)
                                                                                           Total per year (kWh/year) = Sum(64)m =  2146.6946 (64)
Heat gains from water heating, kWh/month
               66.7287    58.7259    61.4656    54.5067    52.6809    46.2182    44.0063    49.3215    49.8746    56.8482    60.4766    65.0251 (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         137.5532   137.5532   137.5532   137.5532   137.5532   137.5532   137.5532   137.5532   137.5532   137.5532   137.5532   137.5532 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               27.4026    24.3388    19.7936    14.9850    11.2015     9.4568    10.2184    13.2822    17.8274    22.6360    26.4195    28.1642 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              258.3806   261.0618   254.3053   239.9215   221.7646   204.6996   193.2992   190.6180   197.3745   211.7583   229.9152   246.9802 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.7553    36.7553    36.7553    36.7553    36.7553    36.7553    36.7553    36.7553    36.7553    36.7553    36.7553    36.7553 (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)
             -110.0425  -110.0425  -110.0425  -110.0425  -110.0425  -110.0425  -110.0425  -110.0425  -110.0425  -110.0425  -110.0425  -110.0425 (71)
Water heating gains (Table 5)
               89.6891    87.3898    82.6150    75.7038    70.8077    64.1919    59.1482    66.2924    69.2702    76.4088    83.9953    87.3994 (72)
Total internal gains
              442.7383   440.0563   423.9799   397.8763   371.0397   345.6143   329.9317   337.4586   351.7381   378.0690   407.5959   429.8097 (73)


----------------------------------------------------------------------------------------------------
6. Solar gains
----------------------------------------------------------------------------------------------------

[Jan]                                         Area           Solar flux                g                  FF             Access                 Gains
                                                m2             Table 6a    Specific data      Specific data             factor                     W
                                                                   W/m2      or Table 6b        or Table 6c           Table 6d
----------------------------------------------------------------------------------------------------
North                                       1.3200              10.6334           0.6300             0.7000             0.7700                4.2896 (74)
East                                        2.9400              19.6403           0.6300             0.7000             0.7700               17.6468 (76)
West                                        2.8600              19.6403           0.6300             0.7000             0.7700               17.1666 (80)
West                                        1.3500              26.4634           0.6300             0.7000             1.0000               14.1795 (82)
----------------------------------------------------------------------------------------------------

Solar gains    53.2826   104.8616   175.1999   260.8898   325.4265   335.8703   318.6226   269.7162   205.3850   125.0017    66.5272    43.7719 (83)
Total gains   496.0208   544.9178   599.1798   658.7661   696.4662   681.4846   648.5544   607.1748   557.1231   503.0707   474.1232   473.5817 (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            67.7686    68.0127    68.2537    69.4088    69.6292    70.6743    70.6743    70.8713    70.2681    69.6292    69.1847    68.7259
alpha           5.5179     5.5342     5.5502     5.6273     5.6419     5.7116     5.7116     5.7248     5.6845     5.6419     5.6123     5.5817
util living area
                0.9993     0.9986     0.9962     0.9857     0.9446     0.8208     0.6501     0.7091     0.9252     0.9918     0.9986     0.9995 (86)

MIT            19.8256    19.9357    20.1474    20.4502    20.7315    20.9258    20.9845    20.9752    20.8326    20.4739    20.1048    19.8145 (87)
Th 2           20.0628    20.0658    20.0688    20.0829    20.0855    20.0979    20.0979    20.1001    20.0931    20.0855    20.0802    20.0746 (88)
util rest of house
                0.9990     0.9981     0.9948     0.9797     0.9190     0.7443     0.5295     0.5909     0.8799     0.9873     0.9979     0.9993 (89)
MIT 2          18.4778    18.6410    18.9524    19.4018    19.7964    20.0419    20.0913    20.0883    19.9397    19.4409    18.8992    18.4701 (90)
Living area fraction                                                                                fLA = Living area / (4) =     0.1718 (91)
MIT            18.7094    18.8635    19.1577    19.5819    19.9570    20.1938    20.2447    20.2407    20.0931    19.6183    19.1063    18.7011 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT   18.7094    18.8635    19.1577    19.5819    19.9570    20.1938    20.2447    20.2407    20.0931    19.6183    19.1063    18.7011 (93)


----------------------------------------------------------------------------------------------------
8. Space heating requirement
----------------------------------------------------------------------------------------------------

                   Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9985     0.9972     0.9927     0.9751     0.9145     0.7534     0.5502     0.6107     0.8799     0.9840     0.9970     0.9988 (94)
Useful gains  495.2689   543.3724   594.8340   642.3899   636.9433   513.4508   356.8122   370.8320   490.2393   495.0115   472.6832   473.0322 (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
             1495.4684  1443.9897  1304.3384  1082.4232   834.0544   556.6801   362.7159   381.1524   599.8673   910.9542  1220.5650  1484.0258 (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
              744.1485   605.2148   527.8713   316.8240   146.6506     0.0000     0.0000     0.0000     0.0000   309.4614   538.4749   752.1792 (98)
Space heating                                                                                                                  3940.8247 (98)
Space heating per m2                                                                                            (98) / (4) =    38.9102 (99)


----------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4219.2983	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	744.1485	605.2148	527.8713	316.8240	146.6506	0.0000	0.0000	0.0000	0.0000	309.4614	538.4749	752.1792	(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)													
	796.7328	647.9816	565.1727	339.2120	157.0135	0.0000	0.0000	0.0000	0.0000	331.3291	576.5256	805.3311	(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													
	213.3317	188.0397	197.5028	175.8659	170.2692	149.9636	143.6766	160.1657	161.9346	183.6159	194.1205	208.2083	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9357	87.7827	87.4066	86.5157	84.6778	80.3000	80.3000	80.3000	80.3000	86.3553	87.4843	88.0004	(217)
Fuel for water heating, kWh/month													
	242.5997	214.2104	225.9587	203.2762	201.0789	186.7542	178.9248	199.4592	201.6620	212.6285	221.8919	236.5993	(219)
Water heating fuel used												2525.0436	(219)
Annual totals kWh/year													
Space heating fuel - main system												4219.2983	(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)												483.9391	(232)
Total delivered energy for all uses												7303.2811	(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	4219.2983	0.2160	911.3684	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2525.0436	0.2160	545.4094	(264)
Space and water heating			1456.7779	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	483.9391	0.5190	251.1644	(268)
Total CO2, kg/m2/year			1746.8673	(272)
Emissions per m2 for space and water heating			14.3837	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4799	(272b)
Emissions per m2 for pumps and fans			0.3843	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3837 * 1.00) + 2.4799 + 0.3843, rounded to 2 d.p.			17.2500	(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	38.9600 (1b)	x	2.3100 (2b)	=	89.9976	(1b) - (3b)
First floor	38.9600 (1c)	x	2.5600 (2c)	=	99.7376	(1c) - (3c)
Second floor	23.3600 (1d)	x	2.3100 (2d)	=	53.9616	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.6968	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1641	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4146	(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) =	0.3835	(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	0.4890	0.4794	0.4698	0.4219	0.4123	0.3644	0.3644	0.3548	0.3835	0.4123	0.4315	0.4507	(22b)
Effective ac	0.6196	0.6149	0.6104	0.5890	0.5850	0.5664	0.5664	0.5629	0.5736	0.5850	0.5931	0.6015	(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	
Entrance Door			2.1300	1.0000	2.1300			(26)
Window (Uw = 1.41)			7.1200	1.3347	9.5032			(27)
Roof Light (Uw = 1.50)			1.3500	1.4151	1.9104			(27a)
150mm B&B			38.9600	0.1400	5.4544			(28a)
50mm Alreflex Plat	86.5200	9.2500	77.2700	0.2700	20.8629			(29a)
Timber Walls to Roofspace	21.2400		21.2400	0.1200	2.5488			(29a)
Gable End	15.7800		15.7800	0.2200	3.4716			(29a)
Horizontal Ceiling	11.9400		11.9400	0.1400	1.6716			(30)
Sloping Ceilings	14.4400	1.3500	13.0900	0.1600	2.0944			(30)
1st Floor to Roofspace	15.2900		15.2900	0.1200	1.8348			(30)
Total net area of external elements Aum(A, m2)			204.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4821			(33)
E-WM-22			38.4200	0.0000	0.0000			(32)
Party Gable			15.7800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	138.8000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6979	(36)
Total fabric heat loss	(33) + (36) = 58.1800	(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	49.8256	49.4522	49.0862	47.3671	47.0455	45.5483	45.5483	45.2710	46.1250	47.0455	47.6962	48.3764	(38)
Heat transfer coeff	108.0056	107.6322	107.2662	105.5471	105.2255	103.7283	103.7283	103.4510	104.3050	105.2255	105.8762	106.5564	(39)
Average = Sum(39)m / 12 =												105.5456	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0664	1.0627	1.0591	1.0421	1.0390	1.0242	1.0242	1.0214	1.0299	1.0390	1.0454	1.0521	(40)
HLP (average)												1.0421	(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	2.7511	(42)
Average daily hot water use (litres/day)	99.5378	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.4915	105.5100	101.5285	97.5470	93.5655	89.5840	89.5840	93.5655	97.5470	101.5285	105.5100	109.4915	(44)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	162.3728	142.0123	146.5439	127.7606	122.5893	105.7852	98.0256	112.4858	113.8292	132.6570	144.8055	157.2494	(45)
Energy content (annual)										Total = Sum(45)m =		1566.1164	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.5042	30.1776	31.1406	27.1491	26.0502	22.4794	20.8304	23.9032	24.1887	28.1896	30.7712	33.4155	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4026	24.3388	19.7936	14.9850	11.2015	9.4568	10.2184	13.2822	17.8274	22.6360	26.4195	28.1642	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.3806	261.0618	254.3053	239.9215	221.7646	204.6996	193.2992	190.6180	197.3745	211.7583	229.9152	246.9802	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	(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)													
	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	(71)
Water heating gains (Table 5)													
	46.3766	44.9072	41.8556	37.7071	35.0137	31.2213	27.9979	32.1280	33.5954	37.8893	42.7377	44.9133	(72)
Total internal gains													
	396.4258	394.5737	380.2205	356.8796	332.2458	309.6437	295.7814	300.2942	313.0633	336.5495	363.3384	384.3237	(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	1.3200	10.6334	0.7100	0.7000	0.7700	4.8343	(74)
East	2.9400	19.6403	0.7100	0.7000	0.7700	19.8877	(76)
West	2.8600	19.6403	0.7100	0.7000	0.7700	19.3465	(80)
West	1.3500	26.4634	0.7100	0.7000	1.0000	15.9801	(82)

Solar gains	60.0486	118.1773	197.4475	294.0187	366.7505	378.5205	359.0826	303.9659	231.4657	140.8749	74.9751	49.3303	(83)
Total gains	456.4744	512.7510	577.6679	650.8983	698.9963	688.1642	654.8641	604.2601	544.5289	477.4243	438.3136	433.6539	(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	36.1547	36.2801	36.4039	36.9968	37.1099	37.6455	37.6455	37.7464	37.4374	37.1099	36.8818	36.6464	
alpha	3.4103	3.4187	3.4269	3.4665	3.4740	3.5097	3.5097	3.5164	3.4958	3.4740	3.4588	3.4431	
util living area													
	0.9931	0.9890	0.9786	0.9501	0.8859	0.7641	0.6229	0.6781	0.8715	0.9676	0.9893	0.9942	(86)
MIT	19.0223	19.2028	19.5470	20.0285	20.4695	20.7953	20.9281	20.9019	20.6372	20.0665	19.4704	19.0014	(87)
Th 2	20.0284	20.0314	20.0344	20.0484	20.0510	20.0632	20.0632	20.0655	20.0585	20.0510	20.0457	20.0401	(88)
util rest of house													
	0.9917	0.9867	0.9740	0.9382	0.8558	0.6975	0.5163	0.5758	0.8259	0.9578	0.9867	0.9931	(89)
MIT 2	18.2034	18.3854	18.7294	19.2136	19.6369	19.9347	20.0319	20.0191	19.8043	19.2579	18.6633	18.1912	(90)
Living area fraction										fLA = Living area / (4) =		0.1718	(91)
MIT	18.3441	18.5258	18.8699	19.3536	19.7799	20.0825	20.1859	20.1708	19.9474	19.3968	18.8020	18.3304	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3441	18.5258	18.8699	19.3536	19.7799	20.0825	20.1859	20.1708	19.9474	19.3968	18.8020	18.3304	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9819	0.9665	0.9273	0.8457	0.6990	0.5314	0.5886	0.8194	0.9488	0.9821	0.9902	(94)
Useful gains	451.1342	503.4829	558.3083	603.5764	591.1194	481.0417	348.0212	355.6454	446.2011	452.9850	430.4512	429.3878	(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													
	1516.8386	1466.5787	1326.8668	1103.3490	850.2167	568.6941	371.9587	390.0923	609.9098	925.6523	1238.9628	1505.6873	(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													
	792.8841	647.2004	571.8075	359.8363	192.7685	0.0000	0.0000	0.0000	0.0000	351.6644	582.1284	800.7668	(98)
Space heating												4299.0564	(98)
Space heating per m2											(98) / (4) =	42.4472	(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	

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	975.0458	767.5892	786.2277	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7430	0.8175	0.7851	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	724.5060	627.5092	617.2563	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	893.3690	853.3161	799.5611	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	121.5813	168.0004	135.6347	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												425.2164	(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	30.3953	42.0001	33.9087	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												106.3041	(107)
Space cooling per m2												1.0496	(108)
Energy for space heating												42.4472	(99)
Energy for space cooling												1.0496	(108)
Total												43.4968	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.5	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.9600 (1b)	x	2.3100 (2b)	=	89.9976	(1b) - (3b)
First floor	38.9600 (1c)	x	2.5600 (2c)	=	99.7376	(1c) - (3c)
Second floor	23.3600 (1d)	x	2.3100 (2d)	=	53.9616	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.2800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.6968	(5)

2. Ventilation rate

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

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/	(5) =	0.1641	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4141	(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) =			0.3831	(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	0.4884	0.4788	0.4693	0.4214	0.4118	0.3639	0.3639	0.3543	0.3831	0.4118	0.4310	0.4501	(22b)
Effective ac	0.6193	0.6146	0.6101	0.5888	0.5848	0.5662	0.5662	0.5628	0.5734	0.5848	0.5929	0.6013	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1300	1.0000	2.1300			(26)
TER Opening Type (Uw = 1.40)			7.1200	1.3258	9.4394			(27)
TER Room Window (Uw = 1.70)			1.3500	1.5918	2.1489			(27a)
150mm B&B			38.9600	0.1300	5.0648			(28a)
50mm Alreflex Plat	86.5200	9.2500	77.2700	0.1800	13.9086			(29a)
Timber Walls to Roofspace	21.2400		21.2400	0.1800	3.8232			(29a)
Gable End	15.7800		15.7800	0.1800	2.8404			(29a)
Horizontal Ceiling	11.9400		11.9400	0.1300	1.5522			(30)
Sloping Ceilings	14.4400	1.3500	13.0900	0.1300	1.7017			(30)
1st Floor to Roofspace	15.2900		15.2900	0.1300	1.9877			(30)
Total net area of external elements Aum(A, m2)			204.1700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.5969			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3853	(36)
Total fabric heat loss (33) + (36) =	53.9822	(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	49.8024	49.4299	49.0648	47.3499	47.0290	45.5354	45.5354	45.2588	46.1107	47.0290	47.6781	48.3567	(38)
Heat transfer coeff	103.7846	103.4121	103.0470	101.3321	101.0112	99.5176	99.5176	99.2410	100.0929	101.0112	101.6603	102.3389	(39)
Average = Sum(39)m / 12 =												101.3305	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0247	1.0211	1.0174	1.0005	0.9973	0.9826	0.9826	0.9799	0.9883	0.9973	1.0038	1.0105	(40)
HLP (average)												1.0005	(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	2.7511 (42)
Average daily hot water use (litres/day)	99.5378 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.4915	105.5100	101.5285	97.5470	93.5655	89.5840	89.5840	93.5655	97.5470	101.5285	105.5100	109.4915	(44)
Energy conte	162.3728	142.0123	146.5439	127.7606	122.5893	105.7852	98.0256	112.4858	113.8292	132.6570	144.8055	157.2494	(45)
Energy content (annual)										Total = Sum(45)m =		1566.1164	(45)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(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	(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	(59)

Heat gains from water heating, kWh/month

	34.5042	30.1776	31.1406	27.1491	26.0502	22.4794	20.8304	23.9032	24.1887	28.1896	30.7712	33.4155 (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	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	137.5532	(66)

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

	27.4026	24.3388	19.7936	14.9850	11.2015	9.4568	10.2184	13.2822	17.8274	22.6360	26.4195	28.1642 (67)

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

	258.3806	261.0618	254.3053	239.9215	221.7646	204.6996	193.2992	190.6180	197.3745	211.7583	229.9152	246.9802 (68)

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

	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553	36.7553 (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)

	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425	-110.0425 (71)

Water heating gains (Table 5)

	46.3766	44.9072	41.8556	37.7071	35.0137	31.2213	27.9979	32.1280	33.5954	37.8893	42.7377	44.9133 (72)

Total internal gains

	396.4258	394.5737	380.2205	356.8796	332.2458	309.6437	295.7814	300.2942	313.0633	336.5495	363.3384	384.3237 (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	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896	(74)
East	2.9400	19.6403	0.6300	0.7000	0.7700	17.6468	(76)
West	2.8600	19.6403	0.6300	0.7000	0.7700	17.1666	(80)
West	1.3500	26.4634	0.6300	0.7000	1.0000	14.1795	(82)

Solar gains	53.2826	104.8616	175.1999	260.8898	325.4265	335.8703	318.6226	269.7162	205.3850	125.0017	66.5272	43.7719	(83)
Total gains	449.7084	499.4352	555.4203	617.7694	657.6723	645.5140	614.4041	570.0104	518.4483	461.5511	429.8656	428.0956	(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	67.7686	68.0127	68.2537	69.4088	69.6292	70.6743	70.6743	70.8713	70.2681	69.6292	69.1847	68.7259	
alpha	5.5179	5.5342	5.5502	5.6273	5.6419	5.7116	5.7116	5.7248	5.6845	5.6419	5.6123	5.5817	
util living area	0.9996	0.9991	0.9974	0.9894	0.9557	0.8452	0.6797	0.7432	0.9427	0.9946	0.9991	0.9997	(86)
MIT	19.7819	19.8928	20.1066	20.4139	20.7035	20.9127	20.9806	20.9685	20.8071	20.4358	20.0630	19.7713	(87)
Th 2	20.0628	20.0658	20.0688	20.0829	20.0855	20.0979	20.0979	20.1001	20.0931	20.0855	20.0802	20.0746	(88)
util rest of house	0.9994	0.9988	0.9964	0.9848	0.9341	0.7727	0.5568	0.6247	0.9049	0.9915	0.9988	0.9996	(89)
MIT 2	18.9369	19.0502	19.2661	19.5826	19.8636	20.0516	20.0921	20.0895	19.9682	19.6082	19.2321	18.9360	(90)
Living area fraction									fLA = Living area / (4) =			0.1718	(91)
MIT	19.0820	19.1950	19.4105	19.7254	20.0079	20.1995	20.2448	20.2405	20.1123	19.7504	19.3748	19.0795	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0820	19.1950	19.4105	19.7254	20.0079	20.1995	20.2448	20.2405	20.1123	19.7504	19.3748	19.0795	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9984	0.9954	0.9823	0.9318	0.7820	0.5781	0.6449	0.9059	0.9899	0.9983	0.9994	(94)
Useful gains	449.3439	498.6193	552.8745	606.8631	612.8227	504.7974	355.1753	367.6265	469.6727	456.9109	429.1532	427.8372	(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	1534.1474	1478.2752	1330.3844	1096.9620	839.1900	557.2514	362.7174	381.1372	601.7924	924.2883	1247.8644	1522.7541	(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	807.0939	658.3288	578.4674	352.8712	168.4173	0.0000	0.0000	0.0000	0.0000	347.7288	589.4720	814.6182	(98)
Space heating												4316.9974	(98)
Space heating per m2											(98) / (4) =	42.6244	(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	935.4653	736.4301	754.2315	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8049	0.8875	0.8552	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	752.9370	653.5593	645.0054	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	845.6276	808.0217	761.2011	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	66.7372	114.9201	86.4496	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												268.1069 (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	16.6843	28.7300	21.6124	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												67.0267 (107)
Space cooling per m2												0.6618 (108)
Energy for space heating												42.6244 (99)
Energy for space cooling												0.6618 (108)
Total												43.2862 (109)
Target Fabric Energy Efficiency (TFEE)												49.8 (109)