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

Property Reference	SECPMW026b_139_As_Built	**Issued on Date**	01/03/2022
Assessment Reference	001	**Prop Type Ref**	TFF
Property			

SAP Rating	84 B	**DER**	18.04	**TER**	18.85
Environmental	87 B	**% DER<TER**	4.30		
CO_2 Emissions (t/year)	1.05	**DFEE**	47.05	**TFEE**	50.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.57		

Assessor Details	Mr. Stephen Smith, Southern Energy Consultants Limited, Tel: 01635261582, info@southernenergyconsultants.co.uk	**Assessor ID**	d168-0001
Client	Bellway Homes Thames Valley		

Regs Region: England
Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r19

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

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DWELLING AS BUILT

Top-floor flat, total floor area 71 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.85 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.04 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.0 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.33 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

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

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3 Air permeability
Air permeability at 50 pascals: 4.17 (measured in this dwelling)
Maximum 10.0 OK

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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

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5 Cylinder insulation
Hot water storage No cylinder

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

Hot water controls: No cylinder

Boiler interlock Yes OK

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

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8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1600
Maximum 0.7 OK

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9 Summertime temperature
Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North West: 11.66 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.8200 (1b)	x	2.4000 (2b)	=	169.9680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		169.9680	(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							0 * 10 =	0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.2085	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1616	(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	0.2060	0.2020	0.1979	0.1777	0.1737	0.1535	0.1535	0.1495	0.1616	0.1737	0.1818	0.1899	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.6600	1.2357	14.4087			(27)
WT-E-02	24.3600	11.6600	12.7000	0.2000	2.5400			(29a)
WT-I-01	24.1200	2.1200	22.0000	0.3300	7.2600			(29a)
Flat Roof	70.8200		70.8200	0.1500	10.6230			(30)
Total net area of external elements Aum(A, m2)			119.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.9517			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2031	(36)
Total fabric heat loss					(33) + (36) =		48.1548	(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	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	(38)
Heat transfer coeff	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	(39)
Average = Sum(39)m / 12 =												76.1995	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	(40)
HLP (average)												1.0760	(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	2.2659	(42)
Average daily hot water use (litres/day)	88.0143	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.8158	93.2952	89.7746	86.2541	82.7335	79.2129	79.2129	82.7335	86.2541	89.7746	93.2952	96.8158	(44)
Energy conte	143.5750	125.5716	129.5786	112.9698	108.3972	93.5386	86.6772	99.4634	100.6513	117.2994	128.0414	139.0447	(45)
Energy content (annual)										Total = Sum(45)m =		1384.8083	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5362	18.8357	19.4368	16.9455	16.2596	14.0308	13.0016	14.9195	15.0977	17.5949	19.2062	20.8567	(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	14.0902	12.7064	14.0357	13.5467	13.9718	13.4906	13.9213	13.9541	13.5212	14.0093	13.5995	14.0796	(61)
Total heat required for water heating calculated for each month													
	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(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													
	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(64)
								Total per year (kWh/year) = Sum(64)m =				1549.7347	(64)
Heat gains from water heating, kWh/month													
	51.2612	44.9292	46.5938	40.9491	39.5350	34.4742	32.3005	36.5601	36.8468	42.5044	45.9737	49.7523	(65)

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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	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.4253	16.3652	13.3091	10.0758	7.5318	6.3587	6.8708	8.9309	11.9870	15.2202	17.7643	18.9374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.2033	201.2704	196.0613	184.9719	170.9735	157.8169	149.0276	146.9605	152.1695	163.2589	177.2574	190.4139	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	(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)													
	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	(71)
Water heating gains (Table 5)													
	68.8995	66.8589	62.6261	56.8738	53.1385	47.8809	43.4147	49.1399	51.1762	57.1295	63.8523	66.8713	(72)
Total internal gains													
	346.5161	344.4825	331.9845	311.9095	291.6318	272.0445	259.3010	265.0192	275.3207	295.5967	318.8619	336.2106	(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	
Northwest	11.6600	11.2829	0.4500	0.0000	0.7700	45.5852	(81)

Solar gains	45.5852	92.7900	167.1782	274.5546	369.0552	393.4519	368.0662	293.4266	203.7092	113.3968	57.3580	37.2272	(83)
Total gains	392.1013	437.2725	499.1627	586.4641	660.6869	665.4964	627.3672	558.4459	479.0299	408.9935	376.2199	373.4378	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	
alpha	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	
util living area													
	0.9987	0.9973	0.9918	0.9649	0.8693	0.6890	0.5253	0.6068	0.8778	0.9853	0.9973	0.9990	(86)
MIT	19.8158	19.9371	20.1803	20.5213	20.8194	20.9608	20.9923	20.9843	20.8584	20.4764	20.0806	19.7806	(87)
Th 2	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	(88)
util rest of house													
	0.9982	0.9963	0.9888	0.9515	0.8235	0.6009	0.4131	0.4880	0.8151	0.9776	0.9962	0.9986	(89)
MIT 2	18.9364	19.0574	19.2991	19.6315	19.8996	20.0029	20.0186	20.0160	19.9389	19.5930	19.2009	18.9013	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.2623	19.3834	19.6257	19.9613	20.2406	20.3579	20.3795	20.3749	20.2797	19.9205	19.5269	19.2272	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1123	19.2334	19.4757	19.8113	20.0906	20.2079	20.2295	20.2249	20.1297	19.7705	19.3769	19.0772	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9953	0.9866	0.9479	0.8272	0.6187	0.4376	0.5138	0.8233	0.9749	0.9952	0.9981	(94)
Useful gains	391.1601	435.2219	492.4826	555.9364	546.5310	411.7695	274.5441	286.9508	394.3790	398.7371	374.4184	372.7432	(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													
	1128.6927	1092.2007	988.7431	831.4387	639.3562	427.3206	276.5648	291.4570	459.4642	698.7841	935.4979	1133.6382	(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													
	548.7243	441.4897	369.2178	198.3616	69.0619	0.0000	0.0000	0.0000	0.0000	223.2350	403.9772	566.1059	(98)
Space heating												2820.1735	(98)
Space heating per m2											(98) / (4) =	39.8217	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3116.2138	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.7243	441.4897	369.2178	198.3616	69.0619	0.0000	0.0000	0.0000	0.0000	223.2350	403.9772	566.1059	(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)	606.3251	487.8340	407.9755	219.1841	76.3115	0.0000	0.0000	0.0000	0.0000	246.6685	446.3837	625.5314	(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	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7656	89.7157	89.5805	89.2263	88.4280	87.3000	87.3000	87.3000	87.3000	89.2879	89.6470	89.7992	(217)
Fuel for water heating, kWh/month	175.6410	154.1292	160.3189	141.7927	138.3826	122.5993	115.2332	129.9169	130.7817	147.0622	157.9986	170.5186	(219)
Water heating fuel used												1744.3749	(219)

Annual totals kWh/year

Space heating fuel - main system	3116.2138	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)

mechanical ventilation fans (SFP = 0.1840)	38.1544	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.1544	(231)
Electricity for lighting (calculated in Appendix L)	325.3965	(232)
Total delivered energy for all uses	5299.1396	(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	3116.2138	0.2160	673.1022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1744.3749	0.2160	376.7850	(264)
Space and water heating			1049.8872	(265)
Pumps and fans	113.1544	0.5190	58.7271	(267)
Energy for lighting	325.3965	0.5190	168.8808	(268)
Total CO2, kg/year			1277.4951	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.0400	(273)

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

DER		18.0400	ZC1
Total Floor Area	TFA	70.8200	
Assumed number of occupants	N	2.2659	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6681	ZC2
CO2 emissions from cooking, equation (L16)		2.4482	ZC3
Total CO2 emissions		37.1563	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		37.1563	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.8200 (1b)	x	2.4000 (2b)	=	169.9680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.9680	(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) =	0.1765	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4265	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3305	(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	0.4214	0.4132	0.4049	0.3636	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3719	0.3884	(22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754	(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			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			11.6600	1.3258	15.4583			(27)
WT-E-02	24.3600	11.6600	12.7000	0.1800	2.2860			(29a)
WT-I-01	24.1200	2.1200	22.0000	0.1800	3.9600			(29a)
Flat Roof	70.8200		70.8200	0.1300	9.2066			(30)
Total net area of external elements Aum(A, m2)			119.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0309			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0631	(36)
Total fabric heat loss						(33) + (36) =	43.0940	(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	33.0258	32.8323	32.6428	31.7523	31.5856	30.8101	30.8101	30.6664	31.1088	31.5856	31.9227	32.2751	(38)
Heat transfer coeff	76.1198	75.9264	75.7368	74.8463	74.6797	73.9041	73.9041	73.7605	74.2028	74.6797	75.0167	75.3691	(39)
Average = Sum(39)m / 12 =												74.8455	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0748	1.0721	1.0694	1.0569	1.0545	1.0435	1.0435	1.0415	1.0478	1.0545	1.0593	1.0642	(40)
HLP (average)												1.0568	(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	2.2659	(42)
Average daily hot water use (litres/day)	88.0143	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.8158	93.2952	89.7746	86.2541	82.7335	79.2129	79.2129	82.7335	86.2541	89.7746	93.2952	96.8158	(44)
Energy conte	143.5750	125.5716	129.5786	112.9698	108.3972	93.5386	86.6772	99.4634	100.6513	117.2994	128.0414	139.0447	(45)
Energy content (annual)										Total = Sum(45)m =		1384.8083	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5362	18.8357	19.4368	16.9455	16.2596	14.0308	13.0016	14.9195	15.0977	17.5949	19.2062	20.8567	(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)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	49.3363	42.9414	45.7482	42.5362	42.1601	39.0639	40.3660	42.1601	42.5362	45.7482	46.0086	49.3363	(61)
Total heat required for water heating calculated for each month	192.9112	168.5130	175.3268	155.5061	150.5573	132.6025	127.0433	141.6235	143.1875	163.0475	174.0500	188.3810	(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	192.9112	168.5130	175.3268	155.5061	150.5573	132.6025	127.0433	141.6235	143.1875	163.0475	174.0500	188.3810	(64)
Total per year (kWh/year) = Sum(64)m =												1912.7496	(64)
Heat gains from water heating, kWh/month	60.0727	52.4879	54.5219	48.1965	46.5821	40.8675	38.9117	43.6116	44.1006	50.4391	54.0759	58.5664	(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	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4253	16.3652	13.3091	10.0758	7.5318	6.3587	6.8708	8.9309	11.9870	15.2202	17.7643	18.9374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.2033	201.2704	196.0613	184.9719	170.9735	157.8169	149.0276	146.9605	152.1695	163.2589	177.2574	190.4139	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	(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)	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	(71)
Water heating gains (Table 5)	80.7429	78.1070	73.2822	66.9396	62.6103	56.7605	52.3007	58.6177	61.2509	67.7945	75.1055	78.7183	(72)
Total internal gains	358.3595	355.7306	342.6406	321.9753	301.1036	280.9241	268.1870	274.4971	285.3953	306.2616	330.1151	348.0576	(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	
Northwest	11.6600	11.2829	0.6300	0.7000	0.7700	40.2062	(81)

Solar gains	40.2062	81.8408	147.4511	242.1571	325.5067	347.0246	324.6344	258.8023	179.6715	100.0160	50.5898	32.8344	(83)
Total gains	398.5657	437.5714	490.0917	564.1325	626.6103	627.9487	592.8213	533.2993	465.0669	406.2776	380.7048	380.8920	(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	64.6094	64.7740	64.9361	65.7087	65.8553	66.5465	66.5465	66.6760	66.2785	65.8553	65.5594	65.2529	
alpha	5.3073	5.3183	5.3291	5.3806	5.3904	5.4364	5.4364	5.4451	5.4186	5.3904	5.3706	5.3502	
util living area	0.9985	0.9973	0.9924	0.9690	0.8835	0.7057	0.5389	0.6154	0.8818	0.9853	0.9972	0.9989	(86)
MIT	19.8259	19.9426	20.1766	20.5157	20.8098	20.9597	20.9923	20.9850	20.8623	20.4920	20.1059	19.8068	(87)
Th 2	20.0214	20.0237	20.0259	20.0362	20.0382	20.0472	20.0472	20.0489	20.0437	20.0382	20.0342	20.0301	(88)
util rest of house	0.9980	0.9963	0.9896	0.9569	0.8409	0.6193	0.4272	0.4986	0.8210	0.9776	0.9960	0.9985	(89)
MIT 2	18.4481	18.6202	18.9626	19.4559	19.8488	20.0201	20.0443	20.0424	19.9265	19.4300	18.8668	18.4264	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	18.9588	19.1104	19.4126	19.8487	20.2050	20.3684	20.3956	20.3918	20.2733	19.8237	19.3261	18.9381	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9588	19.1104	19.4126	19.8487	20.2050	20.3684	20.3956	20.3918	20.2733	19.8237	19.3261	18.9381	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9951	0.9873	0.9540	0.8492	0.6499	0.4689	0.5421	0.8377	0.9753	0.9948	0.9979	(94)
Useful gains	397.4784	435.4230	483.8569	538.1570	532.0966	408.1333	277.9643	289.1265	389.6058	396.2540	378.7166	380.0755	(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	1115.8276	1078.9430	977.9581	819.4711	635.1507	426.3067	280.5139	294.4352	458.0795	688.8201	917.1618	1110.7937	(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	534.4518	432.4455	367.6113	202.5462	76.6722	0.0000	0.0000	0.0000	0.0000	217.6692	387.6805	543.6544	(98)
Space heating												2762.7311	(98)
Space heating per m2											(98) / (4) =	39.0106	(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)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	2957.9562	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	534.4518	432.4455	367.6113	202.5462	76.6722	0.0000	0.0000	0.0000	0.0000	217.6692	387.6805	543.6544	(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)	572.2182	463.0037	393.5881	216.8589	82.0902	0.0000	0.0000	0.0000	0.0000	233.0505	415.0755	582.0710	(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	192.9112	168.5130	175.3268	155.5061	150.5573	132.6025	127.0433	141.6235	143.1875	163.0475	174.0500	188.3810	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4817	87.3203	86.8716	85.7175	83.4458	80.3000	80.3000	80.3000	80.3000	85.7794	87.0091	87.5657	(217)
Fuel for water heating, kWh/month	220.5161	192.9826	201.8230	181.4169	180.4253	165.1338	158.2108	176.3679	178.3157	190.0778	200.0366	215.1310	(219)
Water heating fuel used												2260.4375	(219)

Annual totals kWh/year		
Space heating fuel - main system	2957.9562	(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)	325.3965	(232)
Total delivered energy for all uses	5618.7902	(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	2957.9562	0.2160	638.9185	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2260.4375	0.2160	488.2545	(264)
Space and water heating			1127.1730	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	325.3965	0.5190	168.8808	(268)
Total CO2, kg/m2/year			1334.9788	(272)
Emissions per m2 for space and water heating			15.9160	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3846	(272b)
Emissions per m2 for pumps and fans			0.5496	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9160 * 1.00) + 2.3846 + 0.5496, rounded to 2 d.p.			18.8500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.8200 (1b)	x	2.4000 (2b)	=	169.9680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.9680	(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) =	0.1765	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.3850	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2984	(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	0.3804	0.3730	0.3655	0.3282	0.3208	0.2835	0.2835	0.2760	0.2984	0.3208	0.3357	0.3506	(22b)
Effective ac	0.5724	0.5696	0.5668	0.5539	0.5514	0.5402	0.5402	0.5381	0.5445	0.5514	0.5563	0.5615	(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	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.6600	1.2357	14.4087			(27)
WT-E-02	24.3600	11.6600	12.7000	0.2000	2.5400			(29a)
WT-I-01	24.1200	2.1200	22.0000	0.3300	7.2600			(29a)
Flat Roof	70.8200		70.8200	0.1500	10.6230			(30)
Total net area of external elements Aum(A, m2)			119.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.9517			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2031	(36)
Total fabric heat loss (33) + (36) =	48.1548	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1036	31.9460	31.7915	31.0659	30.9301	30.2981	30.2981	30.1810	30.5415	30.9301	31.2047	31.4919	(38)
Heat transfer coeff	80.2584	80.1008	79.9463	79.2207	79.0849	78.4529	78.4529	78.3359	78.6963	79.0849	79.3596	79.6467	(39)
Average = Sum(39)m / 12 =												79.2200	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1333	1.1310	1.1289	1.1186	1.1167	1.1078	1.1078	1.1061	1.1112	1.1167	1.1206	1.1246	(40)
HLP (average)												1.1186	(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	2.2659	(42)
Average daily hot water use (litres/day)	88.0143	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.8158	93.2952	89.7746	86.2541	82.7335	79.2129	79.2129	82.7335	86.2541	89.7746	93.2952	96.8158	(44)
Energy conte	143.5750	125.5716	129.5786	112.9698	108.3972	93.5386	86.6772	99.4634	100.6513	117.2994	128.0414	139.0447	(45)
Energy content (annual)										Total = Sum(45)m =		1384.8083	(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)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.5097	26.6840	27.5355	24.0061	23.0344	19.8769	18.4189	21.1360	21.3884	24.9261	27.2088	29.5470	(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	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4253	16.3652	13.3091	10.0758	7.5318	6.3587	6.8708	8.9309	11.9870	15.2202	17.7643	18.9374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.2033	201.2704	196.0613	184.9719	170.9735	157.8169	149.0276	146.9605	152.1695	163.2589	177.2574	190.4139	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	(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)	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	(71)
Water heating gains (Table 5)	41.0076	39.7083	37.0100	33.3418	30.9602	27.6069	24.7566	28.4086	29.7061	33.5028	37.7900	39.7137	(72)
Total internal gains	315.6242	314.3318	303.3684	285.3775	266.4535	248.7705	237.6429	241.2879	250.8506	268.9700	289.7996	306.0530	(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	
Northwest	11.6600	11.2829	0.4500	0.0000	0.7700	45.5852	(81)

Solar gains	45.5852	92.7900	167.1782	274.5546	369.0552	393.4519	368.0662	293.4266	203.7092	113.3968	57.3580	37.2272	(83)
Total gains	361.2094	407.1219	470.5466	559.9321	635.5087	642.2224	605.7091	534.7145	454.5598	382.3668	347.1576	343.2802	(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	61.2778	61.3983	61.5170	62.0805	62.1870	62.6880	62.6880	62.7817	62.4941	62.1870	61.9718	61.7484	
alpha	5.0852	5.0932	5.1011	5.1387	5.1458	5.1792	5.1792	5.1854	5.1663	5.1458	5.1315	5.1166	
util living area	0.9991	0.9981	0.9940	0.9727	0.8918	0.7208	0.5561	0.6428	0.9024	0.9895	0.9982	0.9993	(86)
MIT	19.6972	19.8246	20.0794	20.4480	20.7749	20.9476	20.9889	20.9778	20.8226	20.4074	19.9913	19.6743	(87)
Th 2	19.9738	19.9756	19.9773	19.9857	19.9872	19.9945	19.9945	19.9958	19.9917	19.9872	19.9841	19.9808	(88)
util rest of house	0.9987	0.9974	0.9917	0.9617	0.8499	0.6309	0.4361	0.5176	0.8460	0.9838	0.9974	0.9991	(89)
MIT 2	18.7803	18.9090	19.1642	19.5326	19.8334	19.9704	19.9916	19.9893	19.8861	19.4986	19.0825	18.7632	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.1202	19.2484	19.5034	19.8719	20.1824	20.3326	20.3613	20.3557	20.2332	19.8355	19.4193	19.1009	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1202	19.2484	19.5034	19.8719	20.1824	20.3326	20.3613	20.3557	20.2332	19.8355	19.4193	19.1009	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9967	0.9903	0.9602	0.8591	0.6630	0.4811	0.5646	0.8619	0.9826	0.9968	0.9988	(94)
Useful gains	360.6221	405.7884	465.9940	537.6389	545.9392	425.7945	291.3888	301.9022	391.7729	375.7232	346.0526	342.8525	(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	1189.4428	1149.3152	1039.5766	869.1980	670.8288	449.7416	295.0827	309.8716	482.6600	730.3858	977.6575	1186.8071	(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	616.6426	499.6500	426.7454	238.7226	92.9179	0.0000	0.0000	0.0000	0.0000	263.8690	454.7555	627.9022	(98)
Space heating												3221.2052	(98)
Space heating per m2											(98) / (4) =	45.4844	(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	737.4574	580.5515	595.3526	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8855	0.9370	0.9020	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	653.0076	543.9886	537.0239	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	835.1084	790.7483	709.2243	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	131.1126	183.5892	128.1171	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												442.8189	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	32.7781	45.8973	32.0293	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												110.7047	(107)
Space cooling per m2												1.5632	(108)
Energy for space heating												45.4844	(99)
Energy for space cooling												1.5632	(108)
Total												47.0476	(109)
Dwelling Fabric Energy Efficiency (DFEE)												47.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.8200 (1b)	x	2.4000 (2b)	=	169.9680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.9680	(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) =	0.1765	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4265	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3305	(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	0.4214	0.4132	0.4049	0.3636	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3719	0.3884	(22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754	(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			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			11.6600	1.3258	15.4583			(27)
WT-E-02	24.3600	11.6600	12.7000	0.1800	2.2860			(29a)
WT-I-01	24.1200	2.1200	22.0000	0.1800	3.9600			(29a)
Flat Roof	70.8200		70.8200	0.1300	9.2066			(30)
Total net area of external elements Aum(A, m2)			119.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0309			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0631	(36)
Total fabric heat loss						(33) + (36) =	43.0940	(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	33.0258	32.8323	32.6428	31.7523	31.5856	30.8101	30.8101	30.6664	31.1088	31.5856	31.9227	32.2751	(38)
Heat transfer coeff	76.1198	75.9264	75.7368	74.8463	74.6797	73.9041	73.9041	73.7605	74.2028	74.6797	75.0167	75.3691	(39)
Average = Sum(39)m / 12 =												74.8455	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0748	1.0721	1.0694	1.0569	1.0545	1.0435	1.0435	1.0415	1.0478	1.0545	1.0593	1.0642	(40)
HLP (average)												1.0568	(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	2.2659	(42)
Average daily hot water use (litres/day)	88.0143	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.8158	93.2952	89.7746	86.2541	82.7335	79.2129	79.2129	82.7335	86.2541	89.7746	93.2952	96.8158	(44)
Energy conte	143.5750	125.5716	129.5786	112.9698	108.3972	93.5386	86.6772	99.4634	100.6513	117.2994	128.0414	139.0447	(45)
Energy content (annual)										Total = Sum(45)m =		1384.8083	(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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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													
	30.5097	26.6840	27.5355	24.0061	23.0344	19.8769	18.4189	21.1360	21.3884	24.9261	27.2088	29.5470	(65)

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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	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	113.2933	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.4253	16.3652	13.3091	10.0758	7.5318	6.3587	6.8708	8.9309	11.9870	15.2202	17.7643	18.9374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.2033	201.2704	196.0613	184.9719	170.9735	157.8169	149.0276	146.9605	152.1695	163.2589	177.2574	190.4139	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	34.3293	(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)													
	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	(71)
Water heating gains (Table 5)													
	41.0076	39.7083	37.0100	33.3418	30.9602	27.6069	24.7566	28.4086	29.7061	33.5028	37.7900	39.7137	(72)
Total internal gains													
	315.6242	314.3318	303.3684	285.3775	266.4535	248.7705	237.6429	241.2879	250.8506	268.9700	289.7996	306.0530	(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	
Northwest	11.6600	11.2829	0.6300	0.7000	0.7700	40.2062	(81)

Solar gains	40.2062	81.8408	147.4511	242.1571	325.5067	347.0246	324.6344	258.8023	179.6715	100.0160	50.5898	32.8344	(83)
Total gains	355.8304	396.1727	450.8196	527.5346	591.9602	595.7950	562.2773	500.0902	430.5221	368.9860	340.3894	338.8874	(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	64.6094	64.7740	64.9361	65.7087	65.8553	66.5465	66.5465	66.6760	66.2785	65.8553	65.5594	65.2529	
alpha	5.3073	5.3183	5.3291	5.3806	5.3904	5.4364	5.4364	5.4451	5.4186	5.3904	5.3706	5.3502	
util living area													
	0.9992	0.9983	0.9949	0.9765	0.9025	0.7336	0.5655	0.6497	0.9073	0.9904	0.9983	0.9994	(86)
MIT	19.7689	19.8876	20.1256	20.4732	20.7837	20.9514	20.9903	20.9805	20.8360	20.4450	20.0522	19.7505	(87)
Th 2	20.0214	20.0237	20.0259	20.0362	20.0382	20.0472	20.0472	20.0489	20.0437	20.0382	20.0342	20.0301	(88)
util rest of house													
	0.9989	0.9977	0.9929	0.9669	0.8640	0.6474	0.4497	0.5295	0.8542	0.9852	0.9977	0.9991	(89)
MIT 2	18.8903	19.0107	19.2496	19.5999	19.8881	20.0244	20.0446	20.0430	19.9447	19.5775	19.1838	18.8790	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.2159	19.3357	19.5743	19.9236	20.2200	20.3680	20.3951	20.3905	20.2751	19.8991	19.5057	19.2020	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2159	19.3357	19.5743	19.9236	20.2200	20.3680	20.3951	20.3905	20.2751	19.8991	19.5057	19.2020	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9971	0.9917	0.9655	0.8723	0.6782	0.4931	0.5746	0.8693	0.9842	0.9971	0.9989	(94)
Useful gains	355.3129	395.0419	447.0861	509.3400	516.3603	404.0549	277.2350	287.3565	374.2352	363.1621	339.4143	338.5108	(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													
	1135.3991	1096.0542	990.2054	825.0748	636.2731	426.2799	280.4766	294.3421	458.2065	694.4519	930.6340	1130.6878	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	580.3841	471.0803	404.0807	227.3291	89.2151	0.0000	0.0000	0.0000	0.0000	246.4796	425.6782	589.3796	(98)
Space heating												3033.6267	(98)
Space heating per m2											(98) / (4) =	42.8357	(99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Calculated for June, July and August. See Table 10b													
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	694.6984	546.8902	560.5795	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8895	0.9412	0.9089	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	617.9258	514.7207	509.5064	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	780.8427	739.9839	668.7543	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	117.3002	167.5958	118.4804	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												403.3764	(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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	29.3250	41.8989	29.6201	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												100.8441	(107)
Space cooling per m2												1.4239	(108)
Energy for space heating												42.8357	(99)
Energy for space cooling												1.4239	(108)
Total												44.2597	(109)
Target Fabric Energy Efficiency (TFEE)												50.9	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.8200 (1b)	x	2.4000 (2b)	=	169.9680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.9680	(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							0 * 10 =		0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.2085	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1616	(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	0.1697	0.1616	0.1616	0.1495	0.1495	0.1333	0.1373	0.1293	0.1333	0.1414	0.1414	0.1535	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:		0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.6600	1.2357	14.4087			(27)
WT-E-02	24.3600	11.6600	12.7000	0.2000	2.5400			(29a)
WT-I-01	24.1200	2.1200	22.0000	0.3300	7.2600			(29a)
Flat Roof	70.8200		70.8200	0.1500	10.6230			(30)
Total net area of external elements Aum(A, m2)			119.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.9517			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2031	(36)
(33) + (36) = Total fabric heat loss	48.1548	(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	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	(38)
Heat transfer coeff	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	(39)
Average = Sum(39)m / 12 =												76.1995	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	(40)
HLP (average)												1.0760	(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	2.2659	(42)
Average daily hot water use (litres/day)	88.0143	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.8158	93.2952	89.7746	86.2541	82.7335	79.2129	79.2129	82.7335	86.2541	89.7746	93.2952	96.8158	(44)
Energy conte	143.5750	125.5716	129.5786	112.9698	108.3972	93.5386	86.6772	99.4634	100.6513	117.2994	128.0414	139.0447	(45)
Energy content (annual)										Total = Sum(45)m =		1384.8083	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5362	18.8357	19.4368	16.9455	16.2596	14.0308	13.0016	14.9195	15.0977	17.5949	19.2062	20.8567	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	14.0902	12.7064	14.0357	13.5467	13.9718	13.4906	13.9213	13.9541	13.5212	14.0093	13.5995	14.0796	(61)
Total heat required for water heating calculated for each month													
	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(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													
	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(64)
								Total per year (kWh/year) = Sum(64)m =				1549.7347	(64)
RHI water heating demand												1550	(64)
Heat gains from water heating, kWh/month													
	51.2612	44.9292	46.5938	40.9491	39.5350	34.4742	32.3005	36.5601	36.8468	42.5044	45.9737	49.7523	(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	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.0632	40.9130	33.2727	25.1895	18.8295	15.8966	17.1769	22.3272	29.9675	38.0506	44.4106	47.3435	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.3183	300.4035	292.6289	276.0775	255.1843	235.5477	222.4292	219.3440	227.1187	243.6701	264.5632	284.1998	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	(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)													
	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	(71)
Water heating gains (Table 5)													
	68.8995	66.8589	62.6261	56.8738	53.1385	47.8809	43.4147	49.1399	51.1762	57.1295	63.8523	66.8713	(72)
Total internal gains													
	511.4595	507.3538	487.7060	457.3192	426.3307	398.5036	382.1992	389.9894	407.4407	438.0286	472.0046	497.5931	(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	
Northwest	11.6600	12.9236	0.4500	0.0000	0.7700	52.2136	(81)

Solar gains	52.2136	96.1420	171.7296	290.2663	378.7266	431.1226	399.3537	326.7213	226.8338	125.6894	67.4212	42.1524	(83)
Total gains	563.6731	603.4958	659.4357	747.5855	805.0572	829.6262	781.5528	716.7107	634.2745	563.7180	539.4258	539.7454	(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	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	
alpha	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	
util living area													
	0.9907	0.9855	0.9649	0.8884	0.7063	0.4552	0.3019	0.3395	0.6621	0.9232	0.9815	0.9923	(86)
MIT	20.1220	20.2220	20.4622	20.7558	20.9449	20.9955	20.9996	20.9993	20.9704	20.7367	20.3801	20.0913	(87)
Th 2	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	(88)
util rest of house													
	0.9876	0.9808	0.9532	0.8541	0.6369	0.3681	0.2067	0.2360	0.5652	0.8904	0.9743	0.9898	(89)
MIT 2	19.2405	19.3391	19.5727	19.8422	19.9906	20.0192	20.0205	20.0204	20.0087	19.8327	19.4957	19.2103	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.5673	19.6663	19.9024	20.1808	20.3443	20.3811	20.3834	20.3833	20.3652	20.1678	19.8235	19.5369	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4173	19.5163	19.7524	20.0308	20.1943	20.2311	20.2334	20.2333	20.2152	20.0178	19.6735	19.3869	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9777	0.9492	0.8545	0.6499	0.3870	0.2274	0.2586	0.5855	0.8903	0.9710	0.9876	(94)
Useful gains	555.3300	590.0210	625.9602	638.8288	523.1898	321.0897	177.7504	185.3069	371.3645	501.8893	523.7925	533.0730	(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													
	1090.9686	1060.4187	941.2485	771.9644	548.2057	322.4054	177.8039	185.4127	382.1525	641.4336	889.5157	1088.6542	(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													
	398.5151	316.1073	234.5745	95.8576	18.6118	0.0000	0.0000	0.0000	0.0000	103.8209	263.3207	413.3524	(98)
Space heating												1844.1603	(98)
RHI space heating demand												1844	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.8200 (1b)	x	2.4000 (2b)	=	169.9680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.9680	(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							0 * 10	=	0.0000	(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) =	0.0000 / (5) =		0.0000	(8)
Pressure test			Yes	
Measured/design AP50			4.1700	
Infiltration rate			0.2085	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.1616	(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	0.2060	0.2020	0.1979	0.1777	0.1737	0.1535	0.1535	0.1495	0.1616	0.1737	0.1818	0.1899	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.6600	1.2357	14.4087			(27)
WT-E-02	24.3600	11.6600	12.7000	0.2000	2.5400			(29a)
WT-I-01	24.1200	2.1200	22.0000	0.3300	7.2600			(29a)
Flat Roof	70.8200		70.8200	0.1500	10.6230			(30)
Total net area of external elements Aum(A, m2)			119.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.9517			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2031	(36)
Total fabric heat loss					(33) + (36) =		48.1548	(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	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	(38)
Heat transfer coeff	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	(39)
Average = Sum(39)m / 12 =												76.1995	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	(40)
HLP (average)												1.0760	(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	2.2659	(42)
Average daily hot water use (litres/day)	88.0143	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.8158	93.2952	89.7746	86.2541	82.7335	79.2129	79.2129	82.7335	86.2541	89.7746	93.2952	96.8158	(44)
Energy conte	143.5750	125.5716	129.5786	112.9698	108.3972	93.5386	86.6772	99.4634	100.6513	117.2994	128.0414	139.0447	(45)
Energy content (annual)										Total = Sum(45)m =		1384.8083	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5362	18.8357	19.4368	16.9455	16.2596	14.0308	13.0016	14.9195	15.0977	17.5949	19.2062	20.8567	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	14.0902	12.7064	14.0357	13.5467	13.9718	13.4906	13.9213	13.9541	13.5212	14.0093	13.5995	14.0796	(61)
Total heat required for water heating calculated for each month													
	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(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													
	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(64)
									Total per year (kWh/year) = Sum(64)m =			1549.7347	(64)
Heat gains from water heating, kWh/month													
	51.2612	44.9292	46.5938	40.9491	39.5350	34.4742	32.3005	36.5601	36.8468	42.5044	45.9737	49.7523	(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	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	135.9520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.0632	40.9130	33.2727	25.1895	18.8295	15.8966	17.1769	22.3272	29.9675	38.0506	44.4106	47.3435	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.3183	300.4035	292.6289	276.0775	255.1843	235.5477	222.4292	219.3440	227.1187	243.6701	264.5632	284.1998	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	50.8611	(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)													
	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	-90.6347	(71)
Water heating gains (Table 5)													
	68.8995	66.8589	62.6261	56.8738	53.1385	47.8809	43.4147	49.1399	51.1762	57.1295	63.8523	66.8713	(72)
Total internal gains													
	511.4595	507.3538	487.7060	457.3192	426.3307	398.5036	382.1992	389.9894	407.4407	438.0286	472.0046	497.5931	(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	
Northwest	11.6600	11.2829	0.4500	0.0000	0.7700	45.5852	(81)

Solar gains	45.5852	92.7900	167.1782	274.5546	369.0552	393.4519	368.0662	293.4266	203.7092	113.3968	57.3580	37.2272	(83)
Total gains	557.0447	600.1439	654.8842	731.8738	795.3858	791.9555	750.2653	683.4161	611.1499	551.4254	529.3626	534.8203	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	64.5418	
alpha	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	5.3028	
util living area													
	0.9929	0.9883	0.9736	0.9210	0.7891	0.5968	0.4434	0.5055	0.7720	0.9505	0.9872	0.9943	(86)
MIT	20.0329	20.1482	20.3718	20.6666	20.8911	20.9798	20.9965	20.9932	20.9274	20.6393	20.2787	19.9940	(87)
Th 2	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	20.0205	(88)
util rest of house													
	0.9907	0.9847	0.9650	0.8961	0.7332	0.5135	0.3466	0.4017	0.6928	0.9293	0.9824	0.9925	(89)
MIT 2	19.1521	19.2661	19.4851	19.7630	19.9522	20.0120	20.0197	20.0187	19.9833	19.7444	19.3961	19.1135	(90)
Living area fraction										fLA = Living area / (4) =		0.3707	(91)
MIT	19.4786	19.5930	19.8138	20.0979	20.3002	20.3707	20.3817	20.3799	20.3332	20.0761	19.7233	19.4399	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3286	19.4430	19.6638	19.9479	20.1502	20.2207	20.2317	20.2299	20.1832	19.9261	19.5733	19.2899	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9886	0.9819	0.9612	0.8939	0.7412	0.5311	0.3677	0.4243	0.7072	0.9268	0.9796	0.9907	(94)
Useful gains	550.7137	589.2715	629.4539	654.2378	589.5540	420.5810	275.8536	289.9949	432.2069	511.0874	518.5647	529.8411	(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													
	1145.1701	1108.1732	1003.0749	841.8477	643.9013	428.2941	276.7370	291.8387	463.5395	710.6462	950.4572	1149.8414	(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													
	442.2756	348.7019	277.9740	135.0792	40.4344	0.0000	0.0000	0.0000	0.0000	148.4717	310.9626	461.2802	(98)
Space heating												2165.1795	(98)
Space heating per m2											(98) / (4) =	30.5730	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2392.4636	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	442.2756	348.7019	277.9740	135.0792	40.4344	0.0000	0.0000	0.0000	0.0000	148.4717	310.9626	461.2802	(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)	488.7023	385.3060	307.1536	149.2587	44.6789	0.0000	0.0000	0.0000	0.0000	164.0571	343.6050	509.7019	(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	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6365	89.5678	89.3839	88.9236	88.0735	87.3000	87.3000	87.3000	87.3000	88.9694	89.4736	89.6807	(217)
Fuel for water heating, kWh/month	175.8939	154.3837	160.6714	142.2755	138.9397	122.5993	115.2332	129.9169	130.7817	147.5885	158.3047	170.7439	(219)
Water heating fuel used												1747.3324	(219)

Annual totals kWh/year		
Space heating fuel - main system	2392.4636	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)	38.1544	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.1544	(231)
Electricity for lighting (calculated in Appendix L)	325.3965	(232)
Total delivered energy for all uses	4578.3469	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2392.4636	3.4800	83.2577	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1747.3324	3.4800	60.8072	(247)
Mechanical ventilation fans	38.1544	13.1900	5.0326	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	325.3965	13.1900	42.9198	(250)
Additional standing charges			120.0000	(251)
Total energy cost			321.9098	(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] =	1.1673	(257)
SAP value	83.7155	
SAP rating (Section 12)	84	(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	2392.4636	0.2160	516.7721	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1747.3324	0.2160	377.4238	(264)
Space and water heating			894.1959	(265)
Pumps and fans	113.1544	0.5190	58.7271	(267)
Energy for lighting	325.3965	0.5190	168.8808	(268)
Total kg/year			1121.8039	(272)
CO2 emissions per m2			15.8400	(273)
EI value			87.0211	
EI rating			87	(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 / 0.8858 = 3.929, stars = 4
Water heating environmental impact	0.216 / 0.8858 = 0.2439, stars = 4

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.8200 (1b)	x	2.4000 (2b)	=	169.9680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.9680	(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							0 * 10 =		0.0000	(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) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.2085	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1616	(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	0.1697	0.1616	0.1616	0.1495	0.1495	0.1333	0.1373	0.1293	0.1333	0.1414	0.1414	0.1535	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.6600	1.2357	14.4087			(27)
WT-E-02	24.3600	11.6600	12.7000	0.2000	2.5400			(29a)
WT-I-01	24.1200	2.1200	22.0000	0.3300	7.2600			(29a)
Flat Roof	70.8200		70.8200	0.1500	10.6230			(30)
Total net area of external elements Aum(A, m2)			119.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.9517			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2031	(36)
Total fabric heat loss (33) + (36) =	48.1548	(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	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	28.0447	(38)
Heat transfer coeff	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	76.1995	(39)
Average = Sum(39)m / 12 =												76.1995	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	1.0760	(40)
HLP (average)												1.0760	(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	2.2659	(42)
Average daily hot water use (litres/day)	88.0143	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.8158	93.2952	89.7746	86.2541	82.7335	79.2129	79.2129	82.7335	86.2541	89.7746	93.2952	96.8158	(44)
Energy conte	143.5750	125.5716	129.5786	112.9698	108.3972	93.5386	86.6772	99.4634	100.6513	117.2994	128.0414	139.0447	(45)
Energy content (annual)										Total = Sum(45)m =		1384.8083	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5362	18.8357	19.4368	16.9455	16.2596	14.0308	13.0016	14.9195	15.0977	17.5949	19.2062	20.8567	(46)

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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     14.0902    12.7064    14.0357    13.5467    13.9718    13.4906    13.9213    13.9541    13.5212    14.0093    13.5995    14.0796 (61)
Total heat required for water heating calculated for each month
              157.6652   138.2781   143.6144   126.5165   122.3690   107.0292   100.5986   113.4174   114.1724   131.3087   141.6409   153.1244 (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
              157.6652   138.2781   143.6144   126.5165   122.3690   107.0292   100.5986   113.4174   114.1724   131.3087   141.6409   153.1244 (64)
                                                                                                Total per year (kWh/year) = Sum(64)m =   1549.7347 (64)
Heat gains from water heating, kWh/month
               51.2612    44.9292    46.5938    40.9491    39.5350    34.4742    32.3005    36.5601    36.8468    42.5044    45.9737    49.7523 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         135.9520   135.9520   135.9520   135.9520   135.9520   135.9520   135.9520   135.9520   135.9520   135.9520   135.9520   135.9520 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               46.0632    40.9130    33.2727    25.1895    18.8295    15.8966    17.1769    22.3272    29.9675    38.0506    44.4106    47.3435 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              297.3183   300.4035   292.6289   276.0775   255.1843   235.5477   222.4292   219.3440   227.1187   243.6701   264.5632   284.1998 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               50.8611    50.8611    50.8611    50.8611    50.8611    50.8611    50.8611    50.8611    50.8611    50.8611    50.8611    50.8611 (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)
              -90.6347   -90.6347   -90.6347   -90.6347   -90.6347   -90.6347   -90.6347   -90.6347   -90.6347   -90.6347   -90.6347   -90.6347 (71)
Water heating gains (Table 5)
               68.8995    66.8589    62.6261    56.8738    53.1385    47.8809    43.4147    49.1399    51.1762    57.1295    63.8523    66.8713 (72)
Total internal gains
              511.4595   507.3538   487.7060   457.3192   426.3307   398.5036   382.1992   389.9894   407.4407   438.0286   472.0046   497.5931 (73)


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6. Solar gains
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[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
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Northwest                                 11.6600         12.9236          0.4500          0.0000          0.7700         52.2136 (81)
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Solar gains    52.2136    96.1420   171.7296   290.2663   378.7266   431.1226   399.3537   326.7213   226.8338   125.6894    67.4212    42.1524 (83)
Total gains   563.6731   603.4958   659.4357   747.5855   805.0572   829.6262   781.5528   716.7107   634.2745   563.7180   539.4258   539.7454 (84)


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7. Mean internal temperature (heating season)
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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            64.5418    64.5418    64.5418    64.5418    64.5418    64.5418    64.5418    64.5418    64.5418    64.5418    64.5418    64.5418
alpha           5.3028     5.3028     5.3028     5.3028     5.3028     5.3028     5.3028     5.3028     5.3028     5.3028     5.3028     5.3028
util living area
                0.9907     0.9855     0.9649     0.8884     0.7063     0.4552     0.3019     0.3395     0.6621     0.9232     0.9815     0.9923 (86)

MIT            20.1220    20.2220    20.4622    20.7558    20.9449    20.9955    20.9996    20.9993    20.9704    20.7367    20.3801    20.0913 (87)
Th 2           20.0205    20.0205    20.0205    20.0205    20.0205    20.0205    20.0205    20.0205    20.0205    20.0205    20.0205    20.0205 (88)
util rest of house
                0.9876     0.9808     0.9532     0.8541     0.6369     0.3681     0.2067     0.2360     0.5652     0.8904     0.9743     0.9898 (89)
MIT 2          19.2405    19.3391    19.5727    19.8422    19.9906    20.0192    20.0205    20.0204    20.0087    19.8327    19.4957    19.2103 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.3707 (91)
MIT            19.5673    19.6663    19.9024    20.1808    20.3443    20.3811    20.3834    20.3833    20.3652    20.1678    19.8235    19.5369 (92)
Temperature adjustment                                                                                                           -0.1500
adjusted MIT   19.4173    19.5163    19.7524    20.0308    20.1943    20.2311    20.2334    20.2333    20.2152    20.0178    19.6735    19.3869 (93)


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8. Space heating requirement
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                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9852     0.9777     0.9492     0.8545     0.6499     0.3870     0.2274     0.2586     0.5855     0.8903     0.9710     0.9876 (94)
Useful gains  555.3300   590.0210   625.9602   638.8288   523.1898   321.0897   177.7504   185.3069   371.3645   501.8893   523.7925   533.0730 (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
            1090.9686  1060.4187   941.2485   771.9644   548.2057   322.4054   177.8039   185.4127   382.1525   641.4336   889.5157  1088.6542 (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
              398.5151   316.1073   234.5745    95.8576    18.6118     0.0000     0.0000     0.0000     0.0000   103.8209   263.3207   413.3524 (98)
Space heating                                                                                                                  1844.1603 (98)
Space heating per m2                                                                                                 (98) / (4) =     26.0401 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2037.7462	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	398.5151	316.1073	234.5745	95.8576	18.6118	0.0000	0.0000	0.0000	0.0000	103.8209	263.3207	413.3524	(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)	440.3482	349.2898	259.1983	105.9200	20.5655	0.0000	0.0000	0.0000	0.0000	114.7193	290.9621	456.7430	(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	157.6652	138.2781	143.6144	126.5165	122.3690	107.0292	100.5986	113.4174	114.1724	131.3087	141.6409	153.1244	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5693	89.5016	89.2576	88.6512	87.7094	87.3000	87.3000	87.3000	87.3000	88.6846	89.3544	89.6121	(217)
Fuel for water heating, kWh/month	176.0259	154.4978	160.8988	142.7126	139.5164	122.5993	115.2332	129.9169	130.7817	148.0625	158.5159	170.8746	(219)
Water heating fuel used												1749.6357	(219)

Annual totals kWh/year		
Space heating fuel - main system	2037.7462	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)	38.1544	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.1544	(231)
Electricity for lighting (calculated in Appendix L)	325.3965	(232)
Total delivered energy for all uses	4225.9328	(238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2037.7462	3.6300	73.9702	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1749.6357	3.6300	63.5118	(247)
Mechanical ventilation fans	38.1544	19.4400	7.4172	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	325.3965	19.4400	63.2571	(250)
Additional standing charges			95.0000	(251)
Total energy cost			317.7363	(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	2037.7462	0.2160	440.1532	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1749.6357	0.2160	377.9213	(264)
Space and water heating			818.0745	(265)
Pumps and fans	113.1544	0.5190	58.7271	(267)
Energy for lighting	325.3965	0.5190	168.8808	(268)
Total kg/year			1045.6824	(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	2037.7462	1.2200	2486.0504	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1749.6357	1.2200	2134.5555	(264)
Space and water heating			4620.6059	(265)
Pumps and fans	113.1544	3.0700	347.3841	(267)
Energy for lighting	325.3965	3.0700	998.9673	(268)
Primary energy kWh/year			5966.9572	(272)
Primary energy kWh/m2/year			84.2553	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 87

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

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 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	£85	£85	£0
Mains gas	£232	£232	£0
Space heating	£191	£191	£0
Water heating	£64	£64	£0
Lighting	£63	£63	£0
Total cost of fuels	£317	£317	£0
Total cost of uses	£318	£318	£0
Delivered energy	60 kWh/m²	60 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	84 kWh/m²	84 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	336.54	(P1)
Transmission heat loss coefficient	48.15	(37)
Summer heat loss coefficient	384.69	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North West	1.000	0.90	1.000	0.900	(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 West	11.6600	98.8453	0.4500	0.0000	0.9000	466.7770
total:						466.7770

	Jun	Jul	Aug	
Solar gains	504	467	382	(P4)
Internal gains	396	379	387	
Total summer gains	899	846	769	(P5)
Summer gain/loss ratio	2.34	2.20	2.00	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.59	20.35	20.05	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant