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

Property Reference	SECPMW026a_117_As_Built	**Issued on Date**	04/02/2022
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	85 B	**DER**	14.91	**TER**	16.20
Environmental	89 B	**% DER<TER**	7.95		
CO_2 Emissions (t/year)	0.86	**DFEE**	34.64	**TFEE**	37.41
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.39		

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

Mid-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) 16.20 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)37.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)34.6 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	(no roof)		
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: 4.60 (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		4.6000	
Infiltration rate		0.2300	(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) =	0.1783	(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	0.2273	0.2228	0.2184	0.1961	0.1916	0.1693	0.1693	0.1649	0.1783	0.1916	0.2005	0.2094	(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)
Total net area of external elements Aum(A, m2)			48.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3287			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)
Party Ceilings 1			70.8200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.1995	(36)
Total fabric heat loss (33) + (36) =	32.5282	(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	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	(39)
Average = Sum(39)m / 12 =												60.5729	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	(40)
HLP (average)												0.8553	(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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	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)

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)

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	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	
alpha	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	
util living area													
	0.9986	0.9968	0.9883	0.9408	0.7874	0.5748	0.4238	0.4960	0.7996	0.9771	0.9968	0.9990	(86)
MIT	20.1311	20.2442	20.4605	20.7461	20.9396	20.9928	20.9991	20.9977	20.9511	20.6772	20.3457	20.0967	(87)
Th 2	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	(88)
util rest of house													
	0.9981	0.9957	0.9844	0.9222	0.7384	0.5069	0.3479	0.4120	0.7328	0.9666	0.9956	0.9986	(89)
MIT 2	19.4040	19.5166	19.7308	20.0039	20.1673	20.2025	20.2054	20.2050	20.1793	19.9443	19.6181	19.3696	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.6735	19.7863	20.0013	20.2790	20.4536	20.4954	20.4996	20.4988	20.4654	20.2159	19.8878	19.6391	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5235	19.6363	19.8513	20.1290	20.3036	20.3454	20.3496	20.3488	20.3154	20.0659	19.7378	19.4891	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9947	0.9822	0.9201	0.7448	0.5190	0.3617	0.4273	0.7428	0.9642	0.9946	0.9982	(94)
Useful gains	391.1638	434.9647	490.2576	539.6262	492.1033	345.3982	226.9104	238.5962	355.8227	394.3637	374.1987	372.7786	(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													
	922.1326	892.6200	808.7272	680.1741	521.1447	348.0179	227.1250	239.1923	376.4822	573.3802	765.5073	926.1088	(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													
	395.0408	307.5444	236.9414	101.1945	21.6068	0.0000	0.0000	0.0000	0.0000	133.1883	281.7422	411.6777	(98)
Space heating												1888.9360	(98)
Space heating per m2											(98) / (4) =	26.6724	(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	2087.2221	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	395.0408	307.5444	236.9414	101.1945	21.6068	0.0000	0.0000	0.0000	0.0000	133.1883	281.7422	411.6777	(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)	436.5092	339.8280	261.8137	111.8171	23.8749	0.0000	0.0000	0.0000	0.0000	147.1693	311.3173	454.8924	(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	89.5635	89.4827	89.2652	88.6937	87.7657	87.3000	87.3000	87.3000	87.3000	88.8826	89.4037	89.6095	(217)
Fuel for water heating, kWh/month	176.0373	154.5306	160.8851	142.6443	139.4269	122.5993	115.2332	129.9169	130.7817	147.7328	158.4286	170.8796	(219)
Water heating fuel used												1749.0961	(219)

Annual totals kWh/year		
Space heating fuel - main system	2087.2221	(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	4274.8691	(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	2087.2221	0.2160	450.8400	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1749.0961	0.2160	377.8048	(264)
Space and water heating			828.6447	(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			1056.2527	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9100	(273)

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

DER		14.9100	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		34.0263	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		34.0263	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)
Total net area of external elements Aum(A, m2)			48.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.8243			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0595	(36)
Total fabric heat loss					(33) + (36) =		28.8838	(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	61.9096	61.7162	61.5266	60.6361	60.4695	59.6939	59.6939	59.5503	59.9926	60.4695	60.8065	61.1589	(39)
Average = Sum(39)m / 12 =												60.6353	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8742	0.8715	0.8688	0.8562	0.8538	0.8429	0.8429	0.8409	0.8471	0.8538	0.8586	0.8636	(40)
HLP (average)												0.8562	(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	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)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.4393	79.6883	79.9338	81.1077	81.3312	82.3879	82.3879	82.5866	81.9777	81.3312	80.8804	80.4144	
alpha	6.2960	6.3126	6.3289	6.4072	6.4221	6.4925	6.4925	6.5058	6.4652	6.4221	6.3920	6.3610	
util living area													
	0.9985	0.9968	0.9897	0.9499	0.8142	0.5987	0.4418	0.5104	0.8107	0.9777	0.9966	0.9989	(86)
MIT	20.1121	20.2213	20.4310	20.7229	20.9269	20.9914	20.9990	20.9975	20.9482	20.6753	20.3477	20.0948	(87)
Th 2	20.1895	20.1918	20.1941	20.2049	20.2069	20.2163	20.2163	20.2181	20.2127	20.2069	20.2028	20.1986	(88)
util rest of house													
	0.9980	0.9958	0.9862	0.9335	0.7671	0.5296	0.3638	0.4254	0.7453	0.9675	0.9953	0.9985	(89)
MIT 2	18.9912	19.1524	19.4587	19.8789	20.1376	20.2108	20.2159	20.2170	20.1714	19.8212	19.3458	18.9729	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.4067	19.5486	19.8191	20.1917	20.4302	20.5002	20.5062	20.5063	20.4593	20.1378	19.7172	19.3887	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4067	19.5486	19.8191	20.1917	20.4302	20.5002	20.5062	20.5063	20.4593	20.1378	19.7172	19.3887	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9947	0.9841	0.9332	0.7812	0.5550	0.3928	0.4570	0.7673	0.9664	0.9943	0.9980	(94)
Useful gains	397.4992	435.2461	482.3006	526.4331	489.4819	348.5331	232.8423	243.7000	356.8343	392.6068	378.5169	380.1168	(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													
	935.2476	904.0529	819.4789	684.6844	527.9094	352.2029	233.1734	244.5319	381.5113	576.7445	767.2066	928.9241	(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													
	400.0848	315.0382	250.8606	113.9410	28.5900	0.0000	0.0000	0.0000	0.0000	136.9985	279.8566	408.3126	(98)
Space heating												1933.6823	(98)
Space heating per m2											(98) / (4) =	27.3042	(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)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2070.3237	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	400.0848	315.0382	250.8606	113.9410	28.5900	0.0000	0.0000	0.0000	0.0000	136.9985	279.8566	408.3126	(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)	428.3563	337.3000	268.5874	121.9925	30.6103	0.0000	0.0000	0.0000	0.0000	146.6793	299.6323	437.1655	(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	86.8464	86.6039	85.9525	84.2819	81.7578	80.3000	80.3000	80.3000	80.3000	84.6165	86.2407	86.9474	(217)
Fuel for water heating, kWh/month	222.1291	194.5789	203.9810	184.5070	184.1505	165.1338	158.2108	176.3679	178.3157	192.6899	201.8190	216.6609	(219)
Water heating fuel used												2278.5445	(219)

Annual totals kWh/year		
Space heating fuel - main system	2070.3237	(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	4749.2647	(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	2070.3237	0.2160	447.1899	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2278.5445	0.2160	492.1656	(264)
Space and water heating			939.3555	(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			1147.1613	(272)
Emissions per m2 for space and water heating			13.2640	(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) = (13.2640 * 1.00) + 2.3846 + 0.5496, rounded to 2 d.p.			16.2000	(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		4.6000	
Infiltration rate		0.4065	(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) =	0.3150	(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	0.4017	0.3938	0.3859	0.3465	0.3387	0.2993	0.2993	0.2914	0.3150	0.3387	0.3544	0.3702	(22b)
Effective ac	0.5807	0.5775	0.5745	0.5600	0.5573	0.5448	0.5448	0.5425	0.5496	0.5573	0.5628	0.5685	(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)
Total net area of external elements Aum(A, m2)			48.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3287			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)
Party Ceilings 1			70.8200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.1995	(36)
Total fabric heat loss (33) + (36) =	32.5282	(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	32.5696	32.3939	32.2216	31.4127	31.2613	30.5568	30.5568	30.4263	30.8282	31.2613	31.5675	31.8876	(38)
Heat transfer coeff	65.0978	64.9221	64.7499	63.9409	63.7896	63.0850	63.0850	62.9545	63.3564	63.7896	64.0958	64.4158	(39)
Average = Sum(39)m / 12 =												63.9402	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9192	0.9167	0.9143	0.9029	0.9007	0.8908	0.8908	0.8889	0.8946	0.9007	0.9051	0.9096	(40)
HLP (average)												0.9029	(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	75.5487	75.7532	75.9547	76.9156	77.0981	77.9592	77.9592	78.1207	77.6252	77.0981	76.7298	76.3485	
alpha	6.0366	6.0502	6.0636	6.1277	6.1399	6.1973	6.1973	6.2080	6.1750	6.1399	6.1153	6.0899	
util living area	0.9991	0.9980	0.9924	0.9577	0.8287	0.6150	0.4563	0.5360	0.8433	0.9853	0.9981	0.9994	(86)
MIT	19.9947	20.1151	20.3461	20.6703	20.9075	20.9878	20.9983	20.9958	20.9251	20.6018	20.2443	19.9749	(87)
Th 2	20.1512	20.1533	20.1554	20.1651	20.1669	20.1753	20.1753	20.1769	20.1721	20.1669	20.1632	20.1594	(88)
util rest of house	0.9988	0.9973	0.9897	0.9429	0.7815	0.5416	0.3719	0.4431	0.7798	0.9781	0.9973	0.9992	(89)
MIT 2	19.2222	19.3441	19.5755	19.8980	20.1065	20.1700	20.1749	20.1757	20.1300	19.8386	19.4816	19.2093	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.5085	19.6299	19.8611	20.1843	20.4034	20.4731	20.4801	20.4797	20.4247	20.1215	19.7643	19.4931	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5085	19.6299	19.8611	20.1843	20.4034	20.4731	20.4801	20.4797	20.4247	20.1215	19.7643	19.4931	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9967	0.9885	0.9433	0.7958	0.5687	0.4032	0.4777	0.8010	0.9776	0.9968	0.9989	(94)
Useful gains	360.6875	405.7851	465.1281	528.2076	505.7302	365.2193	244.2453	255.4213	364.1093	373.7863	346.0526	342.9157	(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	990.0417	956.2946	865.1315	721.5260	555.1848	370.5052	244.7774	256.8356	400.7128	607.3722	811.7266	985.1182	(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	468.2395	369.9424	297.6025	139.1892	36.7942	0.0000	0.0000	0.0000	0.0000	173.7879	335.2853	477.7986	(98)
Space heating												2298.6397	(98)
Space heating per m2											(98) / (4) =	32.4575	(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	592.9991	466.8291	478.4545	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9620	0.9840	0.9700	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.4839	459.3643	464.0918	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	190.5296	246.5497	182.3786	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												619.4579	(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	47.6324	61.6374	45.5946	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												154.8645	(107)
Space cooling per m2												2.1867	(108)
Energy for space heating												32.4575	(99)
Energy for space cooling												2.1867	(108)
Total												34.6442	(109)
Dwelling Fabric Energy Efficiency (DFEE)												34.6	(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)
Total net area of external elements Aum(A, m2)			48.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.8243			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0595	(36)
Total fabric heat loss					(33) + (36) =		28.8838	(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	61.9096	61.7162	61.5266	60.6361	60.4695	59.6939	59.6939	59.5503	59.9926	60.4695	60.8065	61.1589	(39)
Average = Sum(39)m / 12 =												60.6353	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8742	0.8715	0.8688	0.8562	0.8538	0.8429	0.8429	0.8409	0.8471	0.8538	0.8586	0.8636	(40)
HLP (average)												0.8562	(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)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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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)
-----------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(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
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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
-----------------------------------------------------------------------------------------------------------------------
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            79.4393    79.6883    79.9338    81.1077    81.3312    82.3879    82.3879    82.5866    81.9777    81.3312    80.8804    80.4144
alpha           6.2960     6.3126     6.3289     6.4072     6.4221     6.4925     6.4925     6.5058     6.4652     6.4221     6.3920     6.3610
util living area
                0.9992     0.9982     0.9934     0.9628     0.8421     0.6279     0.4653     0.5428     0.8485     0.9863     0.9982     0.9994 (86)

MIT            20.0529    20.1643    20.3790    20.6837    20.9104    20.9888    20.9986    20.9965    20.9317    20.6286    20.2922    20.0363 (87)
Th 2           20.1895    20.1918    20.1941    20.2049    20.2069    20.2163    20.2163    20.2181    20.2127    20.2069    20.2028    20.1986 (88)
util rest of house
                0.9989     0.9976     0.9910     0.9498     0.7976     0.5567     0.3835     0.4532     0.7877     0.9795     0.9975     0.9992 (89)
MIT 2          19.3123    19.4255    19.6409    19.9464    20.1477    20.2113    20.2159    20.2170    20.1739    19.8992    19.5625    19.3034 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.3707 (91)
MIT            19.5868    19.6994    19.9145    20.2197    20.4304    20.4995    20.5060    20.5059    20.4548    20.1696    19.8330    19.5750 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT   19.5868    19.6994    19.9145    20.2197    20.4304    20.4995    20.5060    20.5059    20.4548    20.1696    19.8330    19.5750 (93)


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

                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9987     0.9971     0.9900     0.9500     0.8110     0.5830     0.4139     0.4865     0.8081     0.9791     0.9971     0.9990 (94)
Useful gains   355.3604   395.0194   446.3129   501.1775   480.1004   347.3306   232.7159   243.3153   347.9021   361.2802   339.3892   338.5586 (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
               946.3985   913.3608   825.3486   686.3827   527.9233   352.1650   233.1663   244.5096   381.2418   578.6672   774.2487   940.3210 (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
               439.7323   348.3254   282.0025   133.3478    35.5802     0.0000     0.0000     0.0000     0.0000   161.7360   313.0988   447.7112 (98)
Space heating                                                                                                                   2161.5343 (98)
Space heating per m2                                                                                                 (98) / (4) =     30.5215 (99)


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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   561.1225   441.7348   452.5820     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation     0.0000     0.0000     0.0000     0.0000     0.0000     0.9640     0.9856     0.9731     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss     0.0000     0.0000     0.0000     0.0000     0.0000   540.9482   435.3522   440.3958     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   172.7240   226.6459   169.8987     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                   569.2687 (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
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	43.1810	56.6615	42.4747	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												142.3172	(107)
Space cooling per m2												2.0096	(108)
Energy for space heating												30.5215	(99)
Energy for space cooling												2.0096	(108)
Total												32.5311	(109)
Target Fabric Energy Efficiency (TFEE)												37.4	(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		4.6000	
Infiltration rate		0.2300	(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) =	0.1783	(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	0.1872	0.1783	0.1783	0.1649	0.1649	0.1471	0.1515	0.1426	0.1471	0.1560	0.1560	0.1693	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:		0.5000	(23a)
Effective ac	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)
Total net area of external elements Aum(A, m2)			48.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3287			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)
Party Ceilings 1			70.8200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.1995	(36)
Total fabric heat loss (33) + (36) =	32.5282	(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	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	(39)
Average = Sum(39)m / 12 =												60.5729	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	(40)
HLP (average)												0.8553	(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)

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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	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

[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)

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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	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	
alpha	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	
util living area													
	0.9864	0.9775	0.9407	0.8152	0.5925	0.3647	0.2402	0.2704	0.5482	0.8694	0.9704	0.9891	(86)
MIT	20.4295	20.5195	20.7149	20.9118	20.9893	20.9996	21.0000	21.0000	20.9950	20.8889	20.6300	20.3985	(87)
Th 2	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	(88)
util rest of house													
	0.9823	0.9709	0.9244	0.7762	0.5372	0.3070	0.1787	0.2033	0.4758	0.8290	0.9604	0.9858	(89)
MIT 2	19.6994	19.7870	19.9729	20.1441	20.2001	20.2055	20.2057	20.2056	20.2037	20.1300	19.8956	19.6691	(90)
Living area fraction									fLA = Living area / (4) =			0.3707	(91)
MIT	19.9700	20.0585	20.2479	20.4286	20.4926	20.4998	20.5001	20.5001	20.4970	20.4113	20.1678	19.9394	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.8200	19.9085	20.0979	20.2786	20.3426	20.3498	20.3501	20.3501	20.3470	20.2613	20.0178	19.7894	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9680	0.9219	0.7800	0.5469	0.3175	0.1899	0.2155	0.4889	0.8321	0.9575	0.9837	(94)
Useful gains	552.3428	584.1865	607.9126	583.1362	440.2788	263.3682	148.4054	154.4585	310.0919	469.0743	516.5029	530.9220	(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													
	891.6339	866.7079	769.1511	628.6636	444.7638	263.4831	148.4083	154.4649	311.7681	524.6408	727.9531	889.7829	(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													
	252.4325	189.8544	119.9614	32.7797	3.3369	0.0000	0.0000	0.0000	0.0000	41.3414	152.2441	266.9925	(98)
Space heating												1058.9431	(98)
RHI space heating demand												1059	(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		4.6000	
Infiltration rate		0.2300	(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) =	0.1783	(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	0.2273	0.2228	0.2184	0.1961	0.1916	0.1693	0.1693	0.1649	0.1783	0.1916	0.2005	0.2094	(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)
Total net area of external elements Aum(A, m2)			48.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3287			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)
Party Ceilings 1			70.8200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.1995	(36)
Total fabric heat loss (33) + (36) =	32.5282	(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	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	(39)
Average = Sum(39)m / 12 =												60.5729	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	(40)
HLP (average)												0.8553	(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)

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	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	81.1923	
alpha	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	6.4128	
util living area													
	0.9901	0.9824	0.9563	0.8657	0.6837	0.4869	0.3549	0.4069	0.6638	0.9154	0.9804	0.9923	(86)
MIT	20.3553	20.4596	20.6468	20.8608	20.9727	20.9971	20.9997	20.9993	20.9828	20.8246	20.5474	20.3176	(87)
Th 2	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	20.2057	(88)
util rest of house													
	0.9872	0.9774	0.9443	0.8347	0.6331	0.4277	0.2910	0.3371	0.5954	0.8872	0.9739	0.9900	(89)
MIT 2	19.6262	19.7285	19.9088	20.1021	20.1893	20.2045	20.2056	20.2055	20.1973	20.0758	19.8157	19.5890	(90)
Living area fraction										fLA = Living area / (4) =		0.3707	(91)
MIT	19.8964	19.9995	20.1824	20.3833	20.4797	20.4983	20.4999	20.4997	20.4884	20.3534	20.0869	19.8591	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7464	19.8495	20.0324	20.2333	20.3297	20.3483	20.3499	20.3497	20.3384	20.2034	19.9369	19.7091	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9851	0.9747	0.9412	0.8359	0.6412	0.4384	0.3027	0.3498	0.6072	0.8871	0.9712	0.9882	(94)
Useful gains	548.7638	584.9508	616.3799	611.7576	510.0180	347.1840	227.0691	239.0585	371.0790	489.1552	514.1273	528.5083	(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													
	935.6356	905.5336	819.6959	686.4914	522.7240	348.1900	227.1436	239.2441	377.8803	581.7038	777.5693	939.4305	(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													
	287.8326	215.4316	151.2671	53.8083	9.4532	0.0000	0.0000	0.0000	0.0000	68.8562	189.6782	305.7261	(98)
Space heating												1282.0534	(98)
Space heating per m2											(98) / (4) =	18.1030	(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	1416.6336	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	287.8326	215.4316	151.2671	53.8083	9.4532	0.0000	0.0000	0.0000	0.0000	68.8562	189.6782	305.7261	(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)	318.0471	238.0460	167.1459	59.4567	10.4456	0.0000	0.0000	0.0000	0.0000	76.0842	209.5892	337.8189	(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	89.3410	89.2215	88.9127	88.2309	87.5219	87.3000	87.3000	87.3000	87.3000	88.3749	89.1037	89.4064	(217)
Fuel for water heating, kWh/month	176.4757	154.9829	161.5229	143.3924	139.8153	122.5993	115.2332	129.9169	130.7817	148.5813	158.9619	171.2679	(219)
Water heating fuel used												1753.5313	(219)

Annual totals kWh/year

Space heating fuel - main system	1416.6336	(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	3608.7158	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1416.6336	3.4800	49.2988	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1753.5313	3.4800	61.0229	(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			288.1666	(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] =	1.0450	(257)
SAP value		85.4225	
SAP rating (Section 12)		85	(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	1416.6336	0.2160	305.9929	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1753.5313	0.2160	378.7628	(264)
Space and water heating			684.7556	(265)
Pumps and fans	113.1544	0.5190	58.7271	(267)
Energy for lighting	325.3965	0.5190	168.8808	(268)
Total kg/year			912.3636	(272)
CO2 emissions per m2			12.8800	(273)
EI value			89.4442	
EI rating			89	(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 / 0.8828 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8828 = 0.2447, 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		4.6000	
Infiltration rate		0.2300	(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) =	0.1783	(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	0.1872	0.1783	0.1783	0.1649	0.1649	0.1471	0.1515	0.1426	0.1471	0.1560	0.1560	0.1693	(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)
Total net area of external elements Aum(A, m2)			48.4800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3287			(33)
Party Wall 1			34.1700	0.0000	0.0000			(32)
Party Floor 1			70.8200					(32d)
Party Ceilings 1			70.8200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.1995	(36)
Total fabric heat loss (33) + (36) =	32.5282	(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	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	60.5729	(39)
Average = Sum(39)m / 12 =												60.5729	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	0.8553	(40)
HLP (average)												0.8553	(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            81.1923    81.1923    81.1923    81.1923    81.1923    81.1923    81.1923    81.1923    81.1923    81.1923    81.1923    81.1923
alpha           6.4128     6.4128     6.4128     6.4128     6.4128     6.4128     6.4128     6.4128     6.4128     6.4128     6.4128     6.4128
util living area
                0.9864     0.9775     0.9407     0.8152     0.5925     0.3647     0.2402     0.2704     0.5482     0.8694     0.9704     0.9891 (86)

MIT            20.4295    20.5195    20.7149    20.9118    20.9893    20.9996    21.0000    21.0000    20.9950    20.8889    20.6300    20.3985 (87)
Th 2           20.2057    20.2057    20.2057    20.2057    20.2057    20.2057    20.2057    20.2057    20.2057    20.2057    20.2057    20.2057 (88)
util rest of house
                0.9823     0.9709     0.9244     0.7762     0.5372     0.3070     0.1787     0.2033     0.4758     0.8290     0.9604     0.9858 (89)
MIT 2          19.6994    19.7870    19.9729    20.1441    20.2001    20.2055    20.2057    20.2056    20.2037    20.1300    19.8956    19.6691 (90)
Living area fraction                                                                                   fLA = Living area / (4) =       0.3707 (91)
MIT            19.9700    20.0585    20.2479    20.4286    20.4926    20.4998    20.5001    20.5001    20.4970    20.4113    20.1678    19.9394 (92)
Temperature adjustment                                                                                                            -0.1500
adjusted MIT   19.8200    19.9085    20.0979    20.2786    20.3426    20.3498    20.3501    20.3501    20.3470    20.2613    20.0178    19.7894 (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     0.9799     0.9680     0.9219     0.7800     0.5469     0.3175     0.1899     0.2155     0.4889     0.8321     0.9575     0.9837 (94)
Useful gains  552.3428   584.1865   607.9126   583.1362   440.2788   263.3682   148.4054   154.4585   310.0919   469.0743   516.5029   530.9220 (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
              891.6339   866.7079   769.1511   628.6636   444.7638   263.4831   148.4083   154.4649   311.7681   524.6408   727.9531   889.7829 (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
              252.4325   189.8544   119.9614    32.7797     3.3369     0.0000     0.0000     0.0000     0.0000    41.3414   152.2441   266.9925 (98)
Space heating                                                                                                                     1058.9431 (98)
Space heating per m2                                                                                                 (98) / (4) =    14.9526 (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	1170.1028	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	252.4325	189.8544	119.9614	32.7797	3.3369	0.0000	0.0000	0.0000	0.0000	41.3414	152.2441	266.9925	(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)	278.9310	209.7838	132.5541	36.2207	3.6871	0.0000	0.0000	0.0000	0.0000	45.6812	168.2256	295.0194	(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	89.2424	89.1233	88.7279	87.9399	87.3820	87.3000	87.3000	87.3000	87.3000	88.0455	88.9289	89.3069	(217)
Fuel for water heating, kWh/month	176.6708	155.1536	161.8593	143.8670	140.0391	122.5993	115.2332	129.9169	130.7817	149.1373	159.2743	171.4587	(219)
Water heating fuel used												1755.9912	(219)

Annual totals kWh/year		
Space heating fuel - main system	1170.1028	(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	3364.6450	(238)

10a. Fuel costs - using BEDF prices (488)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1170.1028	3.6300	42.4747	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1755.9912	3.6300	63.7425	(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			286.4715	(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	1170.1028	0.2160	252.7422	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1755.9912	0.2160	379.2941	(264)
Space and water heating			632.0363	(265)
Pumps and fans	113.1544	0.5190	58.7271	(267)
Energy for lighting	325.3965	0.5190	168.8808	(268)
Total kg/year			859.6443	(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	1170.1028	1.2200	1427.5254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1755.9912	1.2200	2142.3093	(264)
Space and water heating			3569.8348	(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			4916.1861	(272)
Primary energy kWh/m2/year			69.4180	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 85
Current environmental impact rating:	B 89

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 85
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 488 TEST (12 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	£201	£201	£0
Space heating	£159	£159	£0
Water heating	£64	£64	£0
Lighting	£63	£63	£0
Total cost of fuels	£286	£286	£0
Total cost of uses	£286	£286	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 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	32.53	(37)
Summer heat loss coefficient	369.06	(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	2.44	2.29	2.08	(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	18.69	20.44	20.13	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant