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

Property Reference	SECPMW026w_083_As_Built	**Issued on Date**	07/05/2021
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	84 B	**DER**	15.93	**TER**	18.02
Environmental	89 B	**% DER<TER**	11.60		
CO_2 Emissions (t/year)	0.78	**DFEE**	32.14	**TFEE**	39.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.10		

Assessor Details	Mr. Robert Price, Robert Price, Tel: 01635 261582, keith@southernenergyconsultants.co.uk	**Assessor ID**	P865-0001
Client	Bellway Homes Thames Valley		

Regs Region: England
Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r16

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 57 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.02 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.93 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)39.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.23 (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: 3.61 (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): Slight OK
Based on:
Overshading: Average
Windows facing North: 6.42 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
Air permeability 3.6 m³/m²h

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	57.0500 (1b)	x	2.4000 (2b)	=	136.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		136.9200	(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		3.6100	
Infiltration rate		0.1805	(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) =	0.1399	(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	0.1784	0.1749	0.1714	0.1539	0.1504	0.1329	0.1329	0.1294	0.1399	0.1504	0.1574	0.1644	(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)			6.4200	1.2357	7.9335			(27)
WT-E-03	30.7000	6.4200	24.2800	0.1600	3.8848			(29a)
WT-I-02	24.7400	2.1200	22.6200	0.1584	3.5834			(29a)
Total net area of external elements Aum(A, m2)			55.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.5217			(33)
Party Wall 1			27.1200	0.0000	0.0000			(32)
Party Floor 1			57.0500					(32d)
Party Ceilings 1			57.0500					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5034	(36)
Total fabric heat loss (33) + (36) =	24.0251	(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	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	(38)
Heat transfer coeff	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	(39)
Average = Sum(39)m / 12 =												46.6169	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	(40)
HLP (average)												0.8171	(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	1.8971	(42)
Average daily hot water use (litres/day)	79.2566	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.1823	84.0120	80.8417	77.6715	74.5012	71.3310	71.3310	74.5012	77.6715	80.8417	84.0120	87.1823	(44)
Energy conte	129.2888	113.0768	116.6851	101.7289	97.6113	84.2312	78.0526	89.5664	90.6362	105.6277	115.3009	125.2093	(45)
Energy content (annual)										Total = Sum(45)m =		1247.0152	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3933	16.9615	17.5028	15.2593	14.6417	12.6347	11.7079	13.4350	13.5954	15.8442	17.2951	18.7814	(46)

Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0271	12.6533	13.9830	13.5024	13.9311	13.4570	13.8902	13.9167	13.4818	13.9615	13.5453	14.0185	(61)
Total heat required for water heating calculated for each month													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(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													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(64)
									Total per year (kWh/year) = Sum(64)m =			1411.3830	(64)
Heat gains from water heating, kWh/month													
	46.4953	40.7614	42.2935	37.2005	35.9385	31.3711	29.4250	33.2600	33.5070	38.6116	41.7239	45.1367	(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	94.8560	94.8560	94.8560	94.8560	94.8560	94.8560	94.8560	94.8560	94.8560	94.8560	94.8560	94.8560	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.6054	14.7488	11.9945	9.0806	6.7879	5.7306	6.1921	8.0487	10.8030	13.7169	16.0096	17.0669	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	165.4506	167.1675	162.8410	153.6306	142.0040	131.0767	123.7766	122.0597	126.3862	135.5966	147.2232	158.1505	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4856	32.4856	32.4856	32.4856	32.4856	32.4856	32.4856	32.4856	32.4856	32.4856	32.4856	32.4856	(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)													
	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	(71)
Water heating gains (Table 5)													
	62.4937	60.6568	56.8462	51.6673	48.3045	43.5710	39.5498	44.7043	46.5374	51.8973	57.9498	60.6676	(72)
Total internal gains													
	299.0065	297.0298	286.1385	268.8353	251.5532	234.8351	223.9753	229.2696	238.1834	255.6676	275.6394	290.3418	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4200	10.6334	0.4500	0.0000	0.7700	23.6543	(74)

Solar gains	23.6543	45.2046	76.8136	123.3824	166.2074	177.9299	166.1203	131.7953	92.3549	53.8101	29.1806	19.7194	(83)
Total gains	322.6608	342.2344	362.9521	392.2177	417.7605	412.7650	390.0956	361.0649	330.5383	309.4777	304.8200	310.0612	(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	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	
alpha	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	
util living area													
	0.9662	0.9566	0.9347	0.8820	0.7796	0.6302	0.4932	0.5446	0.7551	0.9021	0.9530	0.9701	(86)
MIT	19.3478	19.5021	19.8081	20.2278	20.6182	20.8647	20.9549	20.9370	20.7449	20.2721	19.7346	19.2925	(87)
Th 2	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	(88)
util rest of house													
	0.9618	0.9509	0.9256	0.8648	0.7468	0.5748	0.4181	0.4690	0.7077	0.8843	0.9458	0.9662	(89)
MIT 2	18.7069	18.8594	19.1606	19.5681	19.9338	20.1479	20.2155	20.2046	20.0537	19.6168	19.0910	18.6523	(90)
Living area fraction										fLA = Living area / (4) =		0.5216	(91)
MIT	19.0413	19.1947	19.4984	19.9123	20.2908	20.5219	20.6012	20.5866	20.4142	19.9586	19.4267	18.9863	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8913	19.0447	19.3484	19.7623	20.1408	20.3719	20.4512	20.4366	20.2642	19.8086	19.2767	18.8363	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9520	0.9399	0.9130	0.8525	0.7422	0.5850	0.4398	0.4895	0.7095	0.8726	0.9346	0.9570	(94)
Useful gains	307.1753	321.6533	331.3772	334.3818	310.0595	241.4675	171.5584	176.7429	234.5134	270.0576	284.8967	296.7329	(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													
	680.1990	659.3809	598.9517	506.3648	393.4859	269.0658	179.5321	188.1746	287.3570	429.2777	567.6409	682.2980	(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													
	277.5296	226.9529	199.0754	123.8277	62.0692	0.0000	0.0000	0.0000	0.0000	118.4597	203.5759	286.8604	(98)
Space heating												1498.3509	(98)
Space heating per m2											(98) / (4) =	26.2638	(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	1655.6364	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	277.5296	226.9529	199.0754	123.8277	62.0692	0.0000	0.0000	0.0000	0.0000	118.4597	203.5759	286.8604	(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)	306.6625	250.7767	219.9729	136.8262	68.5848	0.0000	0.0000	0.0000	0.0000	130.8947	224.9457	316.9728	(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 requirement	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(64)
Efficiency of water heater (217)m	89.3842	89.3327	89.2043	88.9288	88.4177	87.3000	87.3000	87.3000	87.3000	88.8636	89.2322	89.4289	(217)
Fuel for water heating, kWh/month	160.3368	140.7437	146.4819	129.5772	126.1539	111.8994	105.3181	118.5374	119.2645	134.5761	144.3942	155.6856	(219)

Water heating fuel used	1592.9688	(219)
Annual totals kWh/year		
Space heating fuel - main system	1655.6364	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)

mechanical ventilation fans (SFP = 0.1840)	30.7358	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	105.7358	(231)
Electricity for lighting (calculated in Appendix L)	293.2562	(232)
Total delivered energy for all uses	3647.5972	(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	1655.6364	0.2160	357.6175	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1592.9688	0.2160	344.0813	(264)
Space and water heating			701.6987	(265)
Pumps and fans	105.7358	0.5190	54.8769	(267)
Energy for lighting	293.2562	0.5190	152.2000	(268)
Total CO2, kg/year			908.7756	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9300	(273)

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

DER		15.9300	ZC1
Total Floor Area	TFA	57.0500	
Assumed number of occupants	N	1.8971	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1854	ZC2
CO2 emissions from cooking, equation (L16)		2.8840	ZC3
Total CO2 emissions		35.9993	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		35.9993	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	57.0500 (1b)	x	2.4000 (2b)	=	136.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1461	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3961	(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) =	0.3070	(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	0.3914	0.3837	0.3760	0.3377	0.3300	0.2916	0.2916	0.2839	0.3070	0.3300	0.3453	0.3607	(22b)
Effective ac	0.5766	0.5736	0.5707	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650	(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)			6.4200	1.3258	8.5114			(27)
WT-E-03	30.7000	6.4200	24.2800	0.1800	4.3704			(29a)
WT-I-02	24.7400	2.1200	22.6200	0.1800	4.0716			(29a)
Total net area of external elements Aum(A, m2)			55.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.0734			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2285	(36)
Total fabric heat loss					(33) + (36) =		24.3019	(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	26.0522	25.9178	25.7861	25.1674	25.0517	24.5129	24.5129	24.4131	24.7204	25.0517	25.2858	25.5306	(38)
Heat transfer coeff	50.3540	50.2196	50.0879	49.4693	49.3536	48.8147	48.8147	48.7150	49.0223	49.3536	49.5877	49.8325	(39)
Average = Sum(39)m / 12 =												49.4687	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8803	0.8780	0.8671	0.8651	0.8556	0.8556	0.8539	0.8593	0.8651	0.8692	0.8735	(40)
HLP (average)												0.8671	(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	1.8971	(42)
Average daily hot water use (litres/day)	79.2566	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.1823	84.0120	80.8417	77.6715	74.5012	71.3310	71.3310	74.5012	77.6715	80.8417	84.0120	87.1823	(44)
Energy conte	129.2888	113.0768	116.6851	101.7289	97.6113	84.2312	78.0526	89.5664	90.6362	105.6277	115.3009	125.2093	(45)
Energy content (annual)										Total = Sum(45)m =		1247.0152	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3933	16.9615	17.5028	15.2593	14.6417	12.6347	11.7079	13.4350	13.5954	15.8442	17.2951	18.7814	(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	44.4271	38.6685	41.1961	38.3037	37.9650	35.1769	36.3495	37.9650	38.3037	41.1961	41.4306	44.4271	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Total heat required for water heating calculated for each month
               173.7159   151.7454   157.8812   140.0327   135.5763   119.4081   114.4020   127.5314   128.9399   146.8238   156.7315   169.6364 (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
               173.7159   151.7454   157.8812   140.0327   135.5763   119.4081   114.4020   127.5314   128.9399   146.8238   156.7315   169.6364 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1722.4246 (64)
Heat gains from water heating, kWh/month
                54.0953    47.2652    49.0968    43.4008    41.9470    36.8011    35.0398    39.2721    39.7125    45.4202    48.6952    52.7389 (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           94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                16.6054    14.7488    11.9945     9.0806     6.7879     5.7306     6.1921     8.0487    10.8030    13.7169    16.0096    17.0669 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               165.4506   167.1675   162.8410   153.6306   142.0040   131.0767   123.7766   122.0597   126.3862   135.5966   147.2232   158.1505 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856 (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)
               -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848 (71)
Water heating gains (Table 5)
                72.7087    70.3351    65.9904    60.2789    56.3804    51.1126    47.0966    52.7851    55.1562    61.0487    67.6322    70.8856 (72)
Total internal gains
               309.2215   306.7081   295.2827   277.4469   259.6291   242.3767   231.5221   237.3503   246.8022   264.8190   285.3218   300.5598 (73)


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

[Jan]                                    Area        Solar flux              g                FF           Access            Gains
                                          m2          Table 6a     Specific data     Specific data          factor              W
                                                         W/m2       or Table 6b       or Table 6c        Table 6d
-----------------------------------------------------------------------------------------------------------
North                                  6.4200          10.6334           0.6300            0.7000           0.7700          20.8631 (74)
-----------------------------------------------------------------------------------------------------------

Solar gains     20.8631    39.8704    67.7496   108.8233   146.5949   156.9342   146.5181   116.2434    81.4570    47.4605    25.7373    17.3925 (83)
Total gains    330.0846   346.5785   363.0323   386.2701   406.2240   399.3109   378.0402   353.5938   328.2592   312.2796   311.0591   317.9523 (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             78.6790    78.8896    79.0970    80.0861    80.2740    81.1600    81.1600    81.3262    80.8164    80.2740    79.8949    79.5024
alpha            6.2453     6.2593     6.2731     6.3391     6.3516     6.4107     6.4107     6.4217     6.3878     6.3516     6.3263     6.3002
util living area
                 0.9982     0.9971     0.9935     0.9770     0.9107     0.7402     0.5615     0.6209     0.8773     0.9829     0.9964     0.9986 (86)

MIT             20.1150    20.1985    20.3668    20.6161    20.8454    20.9707    20.9956    20.9921    20.9126    20.6417    20.3419    20.0991 (87)
Th 2            20.1823    20.1843    20.1863    20.1955    20.1973    20.2054    20.2054    20.2069    20.2022    20.1973    20.1938    20.1901 (88)
util rest of house
                 0.9977     0.9962     0.9912     0.9682     0.8773     0.6649     0.4637     0.5205     0.8214     0.9746     0.9950     0.9982 (89)
MIT 2           18.9900    19.1135    19.3601    19.7257    20.0371    20.1847    20.2036    20.2033    20.1271    19.7667    19.3304    18.9728 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.5216 (91)
MIT             19.5769    19.6795    19.8852    20.1902    20.4587    20.5947    20.6167    20.6148    20.5368    20.2232    19.8580    19.5603 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT    19.5769    19.6795    19.8852    20.1902    20.4587    20.5947    20.6167    20.6148    20.5368    20.2232    19.8580    19.5603 (93)


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

                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9971     0.9954     0.9901     0.9681     0.8893     0.7032     0.5149     0.5731     0.8470     0.9750     0.9943     0.9977 (94)
Useful gains   329.1267   345.0004   359.4423   373.9434   361.2511   280.7883   194.6625   202.6504   278.0282   304.4636   309.2772   317.2176 (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
               769.2508   742.2202   670.4378   558.5175   432.2754   292.6301   196.0766   205.3219   315.5484   474.9378   632.6412   765.4435 (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
               327.4524   266.9317   231.3807   132.8934    52.8421     0.0000     0.0000     0.0000     0.0000   126.8328   232.8220   333.4801 (98)
Space heating                                                                                                                    1704.6351 (98)
Space heating per m2                                                                                                   (98) / (4) =     29.8797 (99)


-----------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-----------------------------------------------------------------------------------------------------------
Not applicable


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9a. Energy requirements - Individual heating systems, including micro-CHP
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Fraction of space heat from secondary/supplementary system (Table 11)                                       0.0000 (201)
Fraction of space heat from main system(s)                                                                   1.0000 (202)
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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	1825.0912	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	327.4524	266.9317	231.3807	132.8934	52.8421	0.0000	0.0000	0.0000	0.0000	126.8328	232.8220	333.4801	(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)	350.5914	285.7941	247.7309	142.2841	56.5761	0.0000	0.0000	0.0000	0.0000	135.7953	249.2741	357.0451	(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	173.7159	151.7454	157.8812	140.0327	135.5763	119.4081	114.4020	127.5314	128.9399	146.8238	156.7315	169.6364	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6234	86.4586	86.0121	84.9198	82.8975	80.3000	80.3000	80.3000	80.3000	84.6852	86.0456	86.7222	(217)
Fuel for water heating, kWh/month	200.5415	175.5122	183.5569	164.9000	163.5470	148.7025	142.4683	158.8187	160.5727	173.3760	182.1492	195.6090	(219)
Water heating fuel used												2049.7540	(219)

Annual totals kWh/year		
Space heating fuel - main system	1825.0912	(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)	293.2562	(232)
Total delivered energy for all uses	4243.1013	(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	1825.0912	0.2160	394.2197	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2049.7540	0.2160	442.7469	(264)
Space and water heating			836.9665	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	293.2562	0.5190	152.2000	(268)
Total CO2, kg/m2/year			1028.0915	(272)
Emissions per m2 for space and water heating			14.6708	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6678	(272b)
Emissions per m2 for pumps and fans			0.6823	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6708 * 1.00) + 2.6678 + 0.6823, rounded to 2 d.p.			18.0200	(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	57.0500 (1b)	x	2.4000 (2b)	=	136.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.0500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	136.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1461	(8)
Pressure test		Yes	
Measured/design AP50		3.6100	
Infiltration rate		0.3266	(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) =	0.2531	(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	0.3227	0.3164	0.3100	0.2784	0.2721	0.2404	0.2404	0.2341	0.2531	0.2721	0.2847	0.2974	(22b)
Effective ac	0.5521	0.5500	0.5481	0.5388	0.5370	0.5289	0.5289	0.5274	0.5320	0.5370	0.5405	0.5442	(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)			6.4200	1.2357	7.9335			(27)
WT-E-03	30.7000	6.4200	24.2800	0.1600	3.8848			(29a)
WT-I-02	24.7400	2.1200	22.6200	0.1584	3.5834			(29a)
Total net area of external elements Aum(A, m2)			55.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.5217			(33)
Party Wall 1			27.1200	0.0000	0.0000			(32)
Party Floor 1			57.0500					(32d)
Party Ceilings 1			57.0500					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5034	(36)
Total fabric heat loss (33) + (36) =	24.0251	(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	24.9443	24.8529	24.7634	24.3428	24.2641	23.8978	23.8978	23.8300	24.0389	24.2641	24.4233	24.5897	(38)
Heat transfer coeff	48.9694	48.8781	48.7885	48.3679	48.2893	47.9229	47.9229	47.8551	48.0640	48.2893	48.4484	48.6149	(39)
Average = Sum(39)m / 12 =												48.3676	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8584	0.8568	0.8552	0.8478	0.8464	0.8400	0.8400	0.8388	0.8425	0.8464	0.8492	0.8521	(40)
HLP (average)												0.8478	(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	1.8971	(42)
Average daily hot water use (litres/day)	79.2566	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.1823	84.0120	80.8417	77.6715	74.5012	71.3310	71.3310	74.5012	77.6715	80.8417	84.0120	87.1823	(44)
Energy conte	129.2888	113.0768	116.6851	101.7289	97.6113	84.2312	78.0526	89.5664	90.6362	105.6277	115.3009	125.2093	(45)
Energy content (annual)										Total = Sum(45)m =		1247.0152	(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
               27.4739   24.0288   24.7956   21.6174   20.7424   17.8991   16.5862   19.0329   19.2602   22.4459   24.5014   26.6070 (65)


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5. Internal gains (see Table 5 and 5a)
-----------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                 Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m          94.8560   94.8560   94.8560   94.8560   94.8560   94.8560   94.8560   94.8560   94.8560   94.8560   94.8560   94.8560 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               16.6054   14.7488   11.9945    9.0806    6.7879    5.7306    6.1921    8.0487   10.8030   13.7169   16.0096   17.0669 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              165.4506  167.1675  162.8410  153.6306  142.0040  131.0767  123.7766  122.0597  126.3862  135.5966  147.2232  158.1505 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               32.4856   32.4856   32.4856   32.4856   32.4856   32.4856   32.4856   32.4856   32.4856   32.4856   32.4856   32.4856 (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)
              -75.8848  -75.8848  -75.8848  -75.8848  -75.8848  -75.8848  -75.8848  -75.8848  -75.8848  -75.8848  -75.8848  -75.8848 (71)
Water heating gains (Table 5)
               36.9272   35.7572   33.3274   30.0242   27.8796   24.8599   22.2932   25.5818   26.7503   30.1692   34.0298   35.7621 (72)
Total internal gains
              270.4400  269.1302  259.6197  244.1921  228.1283  213.1240  203.7187  207.1471  215.3962  230.9395  248.7194  262.4363 (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
-----------------------------------------------------------------------------------------------------------------------------------
North                                  6.4200          10.6334          0.4500            0.0000          0.7700          23.6543 (74)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    23.6543   45.2046   76.8136  123.3824  166.2074  177.9299  166.1203  131.7953   92.3549   53.8101   29.1806   19.7194 (83)
Total gains   294.0943  314.3348  336.4334  367.5745  394.3356  391.0539  369.8390  338.9424  307.7511  284.7497  277.9000  282.1556 (84)


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7. Mean internal temperature (heating season)
-----------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                              21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           32.3615   32.4220   32.4815   32.7639   32.8173   33.0681   33.0681   33.1150   32.9711   32.8173   32.7095   32.5975
alpha          3.1574    3.1615    3.1654    3.1843    3.1878    3.2045    3.2045    3.2077    3.1981    3.1878    3.1806    3.1732
util living area
               0.9743    0.9663    0.9478    0.9013    0.8081    0.6630    0.5254    0.5814    0.7895    0.9218    0.9639    0.9773 (86)

MIT           19.1493   19.3156   19.6447   20.1117   20.5436   20.8335   20.9420   20.9190   20.6891   20.1610   19.5822   19.1109 (87)
Th 2          20.2030   20.2044   20.2058   20.2121   20.2133   20.2188   20.2188   20.2198   20.2167   20.2133   20.2109   20.2084 (88)
util rest of house
               0.9707    0.9616    0.9401    0.8859    0.7768    0.6066    0.4460    0.5023    0.7441    0.9065    0.9581    0.9741 (89)
MIT 2         18.4847   18.6505   18.9766   19.4373   19.8466   20.1064   20.1890   20.1757   19.9888   19.4920   18.9211   18.4506 (90)
Living area fraction                                                                          fLA = Living area / (4) =       0.5216 (91)
MIT           18.8314   18.9975   19.3251   19.7891   20.2102   20.4857   20.5818   20.5635   20.3542   19.8410   19.2660   18.7950 (92)
Temperature adjustment                                                                                                      0.0000
adjusted MIT  18.8314   18.9975   19.3251   19.7891   20.2102   20.4857   20.5818   20.5635   20.3542   19.8410   19.2660   18.7950 (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    0.9630    0.9527    0.9299    0.8765    0.7767    0.6268    0.4840    0.5385    0.7528    0.8980    0.9495    0.9670 (94)
Useful gains 283.2193  299.4714  312.8349  322.1671  306.2713  245.1133  179.0084  182.5154  231.6640  255.7176  263.8555  272.8471 (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
             711.5925  689.0563  625.7183  526.6849  410.9506  282.0593  190.8200  199.2424  300.6000  446.2414  589.4216  709.5350 (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
             318.7097  261.8010  232.7852  147.2528   77.8814    0.0000    0.0000    0.0000    0.0000  141.7497  234.4076  324.8958 (98)
Space heating                                                                                                            1739.4832 (98)
Space heating per m2                                                                                   (98) / (4) =      30.4905 (99)


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8c. Space cooling requirement
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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  450.4757  354.6298  363.6989    0.0000    0.0000    0.0000    0.0000 (100)
Utilisation    0.0000    0.0000    0.0000    0.0000    0.0000    0.8194    0.8750    0.8483    0.0000    0.0000    0.0000    0.0000 (101)
Useful loss    0.0000    0.0000    0.0000    0.0000    0.0000  369.1262  310.2868  308.5202    0.0000    0.0000    0.0000    0.0000 (102)
Total gains    0.0000    0.0000    0.0000    0.0000    0.0000  529.0155  502.9035  468.1510    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  115.1203  143.3069  118.7653    0.0000    0.0000    0.0000    0.0000 (104)
Space cooling                                                                                                            377.1925 (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	28.7801	35.8267	29.6913	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												94.2981	(107)
Space cooling per m2												1.6529	(108)
Energy for space heating												30.4905	(99)
Energy for space cooling												1.6529	(108)
Total												32.1434	(109)
Dwelling Fabric Energy Efficiency (DFEE)												32.1	(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	57.0500 (1b)	x	2.4000 (2b)	=	136.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1461	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3961	(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) =	0.3070	(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	0.3914	0.3837	0.3760	0.3377	0.3300	0.2916	0.2916	0.2839	0.3070	0.3300	0.3453	0.3607	(22b)
Effective ac	0.5766	0.5736	0.5707	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650	(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)			6.4200	1.3258	8.5114			(27)
WT-E-03	30.7000	6.4200	24.2800	0.1800	4.3704			(29a)
WT-I-02	24.7400	2.1200	22.6200	0.1800	4.0716			(29a)
Total net area of external elements Aum(A, m2)			55.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.0734			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2285	(36)
Total fabric heat loss					(33) + (36) =		24.3019	(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	26.0522	25.9178	25.7861	25.1674	25.0517	24.5129	24.5129	24.4131	24.7204	25.0517	25.2858	25.5306	(38)
Heat transfer coeff	50.3540	50.2196	50.0879	49.4693	49.3536	48.8147	48.8147	48.7150	49.0223	49.3536	49.5877	49.8325	(39)
Average = Sum(39)m / 12 =												49.4687	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8803	0.8780	0.8671	0.8651	0.8556	0.8556	0.8539	0.8593	0.8651	0.8692	0.8735	(40)
HLP (average)												0.8671	(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	1.8971	(42)
Average daily hot water use (litres/day)	79.2566	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.1823	84.0120	80.8417	77.6715	74.5012	71.3310	71.3310	74.5012	77.6715	80.8417	84.0120	87.1823	(44)
Energy conte	129.2888	113.0768	116.6851	101.7289	97.6113	84.2312	78.0526	89.5664	90.6362	105.6277	115.3009	125.2093	(45)
Energy content (annual)										Total = Sum(45)m =		1247.0152	(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
                27.4739    24.0288    24.7956    21.6174    20.7424    17.8991    16.5862    19.0329    19.2602    22.4459    24.5014    26.6070 (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           94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560    94.8560 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                16.6054    14.7488    11.9945     9.0806     6.7879     5.7306     6.1921     8.0487    10.8030    13.7169    16.0096    17.0669 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               165.4506   167.1675   162.8410   153.6306   142.0040   131.0767   123.7766   122.0597   126.3862   135.5966   147.2232   158.1505 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856    32.4856 (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)
               -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848   -75.8848 (71)
Water heating gains (Table 5)
                36.9272    35.7572    33.3274    30.0242    27.8796    24.8599    22.2932    25.5818    26.7503    30.1692    34.0298    35.7621 (72)
Total internal gains
               270.4400   269.1302   259.6197   244.1921   228.1283   213.1240   203.7187   207.1471   215.3962   230.9395   248.7194   262.4363 (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
-----------------------------------------------------------------------------------------------------------------------------------
North                                    6.4200          10.6334           0.6300            0.7000          0.7700          20.8631 (74)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains     20.8631    39.8704    67.7496   108.8233   146.5949   156.9342   146.5181   116.2434    81.4570    47.4605    25.7373    17.3925 (83)
Total gains    291.3031   309.0006   327.3694   353.0154   374.7232   370.0582   350.2369   323.3905   296.8532   278.4001   274.4567   279.8288 (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             78.6790    78.8896    79.0970    80.0861    80.2740    81.1600    81.1600    81.3262    80.8164    80.2740    79.8949    79.5024
alpha            6.2453     6.2593     6.2731     6.3391     6.3516     6.4107     6.4107     6.4217     6.3878     6.3516     6.3263     6.3002
util living area
                 0.9991     0.9985     0.9963     0.9853     0.9347     0.7821     0.6027     0.6713     0.9141     0.9905     0.9982     0.9993 (86)

MIT             20.0485    20.1344    20.3070    20.5648    20.8112    20.9600    20.9935    20.9878    20.8837    20.5876    20.2795    20.0335 (87)
Th 2            20.1823    20.1843    20.1863    20.1955    20.1973    20.2054    20.2054    20.2069    20.2022    20.1973    20.1938    20.1901 (88)
util rest of house
                 0.9988     0.9980     0.9949     0.9793     0.9075     0.7083     0.4994     0.5665     0.8679     0.9856     0.9975     0.9991 (89)
MIT 2           19.3019    19.3893    19.5631    19.8257    20.0595    20.1853    20.2035    20.2029    20.1301    19.8513    19.5423    19.2934 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.5216 (91)
MIT             19.6913    19.7780    19.9511    20.2112    20.4516    20.5894    20.6156    20.6124    20.5232    20.2354    19.9268    19.6795 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT    19.6913    19.7780    19.9511    20.2112    20.4516    20.5894    20.6156    20.6124    20.5232    20.2354    19.9268    19.6795 (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      0.9986     0.9977     0.9944     0.9794     0.9171     0.7457     0.5536     0.6216     0.8887     0.9859     0.9972     0.9989 (94)
Useful gains   290.8995   308.2783   325.5411   345.7401   343.6637   275.9580   193.9026   201.0218   263.8251   274.4740   273.6895   279.5288 (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
               775.0155   747.1665   673.7391   559.5584   431.9245   292.3727   196.0217   205.2059   314.8813   475.5401   636.0531   771.3815 (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
               360.1823   294.9329   259.0593   153.9492    65.6661     0.0000     0.0000     0.0000     0.0000   149.5932   260.9018   365.9384 (98)
Space heating                                                                                                                    1910.2231 (98)
Space heating per m2                                                                                                   (98) / (4) =     33.4833 (99)


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8c. Space cooling requirement
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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   458.8586   361.2291   370.2338     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation      0.0000     0.0000     0.0000     0.0000     0.0000     0.9024     0.9545     0.9338     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss      0.0000     0.0000     0.0000     0.0000     0.0000   414.0708   344.7793   345.7217     0.0000     0.0000     0.0000     0.0000 (102)
Total gains      0.0000     0.0000     0.0000     0.0000     0.0000   504.4751   479.9919   449.9736     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    65.0910   100.5982    77.5634     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                    243.2526 (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	16.2728	25.1495	19.3908	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												60.8132	(107)
Space cooling per m2												1.0660	(108)
Energy for space heating												33.4833	(99)
Energy for space cooling												1.0660	(108)
Total												34.5493	(109)
Target Fabric Energy Efficiency (TFEE)												39.7	(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	57.0500 (1b)	x	2.4000 (2b)	=	136.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.0500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	136.9200	(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		3.6100	
Infiltration rate		0.1805	(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) =	0.1399	(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	0.1469	0.1399	0.1399	0.1294	0.1294	0.1154	0.1189	0.1119	0.1154	0.1224	0.1224	0.1329	(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)			6.4200	1.2357	7.9335			(27)
WT-E-03	30.7000	6.4200	24.2800	0.1600	3.8848			(29a)
WT-I-02	24.7400	2.1200	22.6200	0.1584	3.5834			(29a)
Total net area of external elements Aum(A, m2)			55.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.5217			(33)
Party Wall 1			27.1200	0.0000	0.0000			(32)
Party Floor 1			57.0500					(32d)
Party Ceilings 1			57.0500					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5034	(36)
Total fabric heat loss (33) + (36) =	24.0251	(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	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	(38)
Heat transfer coeff	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	(39)
Average = Sum(39)m / 12 =												46.6169	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	(40)
HLP (average)												0.8171	(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	1.8971	(42)
Average daily hot water use (litres/day)	79.2566	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.1823	84.0120	80.8417	77.6715	74.5012	71.3310	71.3310	74.5012	77.6715	80.8417	84.0120	87.1823	(44)
Energy conte	129.2888	113.0768	116.6851	101.7289	97.6113	84.2312	78.0526	89.5664	90.6362	105.6277	115.3009	125.2093	(45)
Energy content (annual)										Total = Sum(45)m =		1247.0152	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3933	16.9615	17.5028	15.2593	14.6417	12.6347	11.7079	13.4350	13.5954	15.8442	17.2951	18.7814	(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	14.0271	12.6533	13.9830	13.5024	13.9311	13.4570	13.8902	13.9167	13.4818	13.9615	13.5453	14.0185	(61)
Total heat required for water heating calculated for each month													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(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													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(64)
								Total per year (kWh/year) = Sum(64)m =				1411.3830	(64)
RHI water heating demand												1411	(64)
Heat gains from water heating, kWh/month													
	46.4953	40.7614	42.2935	37.2005	35.9385	31.3711	29.4250	33.2600	33.5070	38.6116	41.7239	45.1367	(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	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	41.5134	36.8719	29.9862	22.7015	16.9696	14.3265	15.4803	20.1218	27.0075	34.2922	40.0241	42.6672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	246.9412	249.5037	243.0463	229.2994	211.9463	195.6369	184.7412	182.1787	188.6361	202.3830	219.7361	236.0455	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	(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)													
	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	(71)
Water heating gains (Table 5)													
	62.4937	60.6568	56.8462	51.6673	48.3045	43.5710	39.5498	44.7043	46.5374	51.8973	57.9498	60.6676	(72)
Total internal gains													
	440.1706	436.2546	419.1010	392.8905	366.4427	342.7566	328.9935	336.2271	351.4033	377.7948	406.9322	428.6026	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4200	11.9814	0.4500	0.0000	0.7700	26.6531	(74)

Solar gains	26.6531	46.2413	78.4165	130.3669	170.8487	195.3851	180.5989	146.8414	102.4689	59.0255	33.7711	21.9503	(83)
Total gains	466.8237	482.4959	497.5175	523.2574	537.2914	538.1417	509.5923	483.0685	453.8722	436.8203	440.7034	450.5530	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	
alpha	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	
util living area													
	0.9050	0.8903	0.8487	0.7613	0.6125	0.4167	0.2803	0.3042	0.5459	0.7668	0.8703	0.9124	(86)
MIT	19.8718	19.9794	20.2504	20.5785	20.8448	20.9687	20.9940	20.9921	20.9200	20.6345	20.2125	19.8314	(87)
Th 2	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	(88)
util rest of house													
	0.8941	0.8777	0.8308	0.7332	0.5688	0.3582	0.2128	0.2337	0.4866	0.7336	0.8533	0.9021	(89)
MIT 2	19.2178	19.3220	19.5832	19.8906	20.1258	20.2215	20.2365	20.2358	20.1889	19.9473	19.5502	19.1791	(90)
Living area fraction									fLA = Living area / (4) =			0.5216	(91)
MIT	19.5589	19.6649	19.9312	20.2494	20.5008	20.6113	20.6317	20.6303	20.5702	20.3058	19.8957	19.5194	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4089	19.5149	19.7812	20.0994	20.3508	20.4613	20.4817	20.4803	20.4202	20.1558	19.7457	19.3694	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8803	0.8641	0.8190	0.7277	0.5755	0.3756	0.2345	0.2563	0.5013	0.7297	0.8410	0.8885	(94)
Useful gains	410.9642	416.9355	407.4478	380.7798	309.1936	202.1528	119.5231	123.8260	227.5054	318.7376	370.6271	400.2940	(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													
	667.0387	648.6703	577.1744	475.4647	342.6738	207.9710	120.3494	124.9477	243.3516	398.8454	547.5466	665.1935	(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													
	190.5194	155.7258	126.2766	68.1731	24.9093	0.0000	0.0000	0.0000	0.0000	59.6002	127.3821	197.0852	(98)
Space heating												949.6717	(98)
RHI space heating demand												950	(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	57.0500 (1b)	x	2.4000 (2b)	=	136.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.0500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	136.9200	(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		3.6100	
Infiltration rate		0.1805	(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) =	0.1399	(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	0.1784	0.1749	0.1714	0.1539	0.1504	0.1329	0.1329	0.1294	0.1399	0.1504	0.1574	0.1644	(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)			6.4200	1.2357	7.9335			(27)
WT-E-03	30.7000	6.4200	24.2800	0.1600	3.8848			(29a)
WT-I-02	24.7400	2.1200	22.6200	0.1584	3.5834			(29a)
Total net area of external elements Aum(A, m2)			55.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.5217			(33)
Party Wall 1			27.1200	0.0000	0.0000			(32)
Party Floor 1			57.0500					(32d)
Party Ceilings 1			57.0500					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5034	(36)
Total fabric heat loss						(33) + (36) =	24.0251	(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	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	(38)
Heat transfer coeff	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	(39)
Average = Sum(39)m / 12 =												46.6169	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	(40)
HLP (average)												0.8171	(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	1.8971	(42)
Average daily hot water use (litres/day)	79.2566	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.1823	84.0120	80.8417	77.6715	74.5012	71.3310	71.3310	74.5012	77.6715	80.8417	84.0120	87.1823	(44)
Energy conte	129.2888	113.0768	116.6851	101.7289	97.6113	84.2312	78.0526	89.5664	90.6362	105.6277	115.3009	125.2093	(45)
Energy content (annual)										Total = Sum(45)m =		1247.0152	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3933	16.9615	17.5028	15.2593	14.6417	12.6347	11.7079	13.4350	13.5954	15.8442	17.2951	18.7814	(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	14.0271	12.6533	13.9830	13.5024	13.9311	13.4570	13.8902	13.9167	13.4818	13.9615	13.5453	14.0185	(61)
Total heat required for water heating calculated for each month													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(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													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(64)
								Total per year (kWh/year) = Sum(64)m =				1411.3830	(64)
Heat gains from water heating, kWh/month													
	46.4953	40.7614	42.2935	37.2005	35.9385	31.3711	29.4250	33.2600	33.5070	38.6116	41.7239	45.1367	(65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	41.5134	36.8719	29.9862	22.7015	16.9696	14.3265	15.4803	20.1218	27.0075	34.2922	40.0241	42.6672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	246.9412	249.5037	243.0463	229.2994	211.9463	195.6369	184.7412	182.1787	188.6361	202.3830	219.7361	236.0455	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	(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)													
	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	(71)
Water heating gains (Table 5)													
	62.4937	60.6568	56.8462	51.6673	48.3045	43.5710	39.5498	44.7043	46.5374	51.8973	57.9498	60.6676	(72)
Total internal gains													
	440.1706	436.2546	419.1010	392.8905	366.4427	342.7566	328.9935	336.2271	351.4033	377.7948	406.9322	428.6026	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4200	10.6334	0.4500	0.0000	0.7700	23.6543	(74)

Solar gains	23.6543	45.2046	76.8136	123.3824	166.2074	177.9299	166.1203	131.7953	92.3549	53.8101	29.1806	19.7194	(83)
Total gains	463.8249	481.4592	495.9146	516.2728	532.6501	520.6865	495.1138	468.0224	443.7581	431.6049	436.1128	448.3220	(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	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	
alpha	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	
util living area													
	0.9163	0.9010	0.8679	0.7983	0.6817	0.5292	0.4003	0.4381	0.6315	0.8080	0.8900	0.9238	(86)
MIT	19.7487	19.8788	20.1308	20.4622	20.7506	20.9194	20.9755	20.9667	20.8533	20.5183	20.0802	19.6938	(87)
Th 2	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	(88)
util rest of house													
	0.9069	0.8899	0.8526	0.7745	0.6448	0.4765	0.3357	0.3719	0.5803	0.7808	0.8759	0.9151	(89)
MIT 2	19.0974	19.2240	19.4682	19.7829	20.0452	20.1863	20.2265	20.2213	20.1371	19.8409	19.4226	19.0441	(90)
Living area fraction										fLA = Living area / (4) =		0.5216	(91)
MIT	19.4372	19.5656	19.8139	20.1373	20.4132	20.5687	20.6172	20.6101	20.5107	20.1942	19.7656	19.3830	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2872	19.4156	19.6639	19.9873	20.2632	20.4187	20.4672	20.4601	20.3607	20.0442	19.6156	19.2330	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8932	0.8761	0.8397	0.7660	0.6460	0.4893	0.3555	0.3916	0.5889	0.7731	0.8628	0.9016	(94)
Useful gains	414.2967	421.7991	416.4396	395.4836	344.1098	254.7880	175.9911	183.2863	261.3249	333.6950	376.2574	404.2187	(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													
	698.6553	676.6719	613.6585	516.8546	399.1904	271.2494	180.2771	189.2704	291.8547	440.2615	583.4400	700.7933	(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													
	211.5628	171.2745	146.7309	87.3871	40.9800	0.0000	0.0000	0.0000	0.0000	79.2855	149.1715	220.6515	(98)
Space heating												1107.0438	(98)
Space heating per m2											(98) / (4) =	19.4048	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1223.2528	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	211.5628	171.2745	146.7309	87.3871	40.9800	0.0000	0.0000	0.0000	0.0000	79.2855	149.1715	220.6515	(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)	233.7711	189.2536	162.1335	96.5603	45.2817	0.0000	0.0000	0.0000	0.0000	87.6083	164.8304	243.8138	(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 requirement	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(64)
Efficiency of water heater (217)m	89.1799	89.1172	88.9639	88.6519	88.1373	87.3000	87.3000	87.3000	87.3000	88.5482	88.9883	89.2346	(217)
Fuel for water heating, kWh/month	160.7043	141.0840	146.8776	129.9818	126.5552	111.8994	105.3181	118.5374	119.2645	135.0554	144.7900	156.0246	(219)

Water heating fuel used	1596.0924	(219)
Annual totals kWh/year		
Space heating fuel - main system	1223.2528	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)

mechanical ventilation fans (SFP = 0.1840)	30.7358	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	105.7358	(231)
Electricity for lighting (calculated in Appendix L)	293.2562	(232)
Total delivered energy for all uses	3218.3372	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1223.2528	3.4800	42.5692	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1596.0924	3.4800	55.5440	(247)
Mechanical ventilation fans	30.7358	13.1900	4.0541	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	293.2562	13.1900	38.6805	(250)
Additional standing charges			120.0000	(251)
Total energy cost			270.7403	(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] =	1.1143	(257)
SAP value		84.4560	
SAP rating (Section 12)		84	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1223.2528	0.2160	264.2226	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1596.0924	0.2160	344.7560	(264)
Space and water heating			608.9786	(265)
Pumps and fans	105.7358	0.5190	54.8769	(267)
Energy for lighting	293.2562	0.5190	152.2000	(268)
Total kg/year			816.0554	(272)
CO2 emissions per m2			14.3000	(273)
EI value			89.2845	
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 / 0.8834 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8834 = 0.2445, 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	57.0500 (1b)	x	2.4000 (2b)	=	136.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		136.9200	(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		3.6100	
Infiltration rate		0.1805	(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) =	0.1399	(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	0.1469	0.1399	0.1399	0.1294	0.1294	0.1154	0.1189	0.1119	0.1154	0.1224	0.1224	0.1329	(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)			6.4200	1.2357	7.9335			(27)
WT-E-03	30.7000	6.4200	24.2800	0.1600	3.8848			(29a)
WT-I-02	24.7400	2.1200	22.6200	0.1584	3.5834			(29a)
Total net area of external elements Aum(A, m2)			55.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.5217			(33)
Party Wall 1			27.1200	0.0000	0.0000			(32)
Party Floor 1			57.0500					(32d)
Party Ceilings 1			57.0500					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5034	(36)
Total fabric heat loss (33) + (36) =	24.0251	(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	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	22.5918	(38)
Heat transfer coeff	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	46.6169	(39)
Average = Sum(39)m / 12 =												46.6169	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	0.8171	(40)
HLP (average)												0.8171	(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	1.8971	(42)
Average daily hot water use (litres/day)	79.2566	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.1823	84.0120	80.8417	77.6715	74.5012	71.3310	71.3310	74.5012	77.6715	80.8417	84.0120	87.1823	(44)
Energy conte	129.2888	113.0768	116.6851	101.7289	97.6113	84.2312	78.0526	89.5664	90.6362	105.6277	115.3009	125.2093	(45)
Energy content (annual)										Total = Sum(45)m =		1247.0152	(45)
Distribution loss (46)m = 0.15 x (45)m	19.3933	16.9615	17.5028	15.2593	14.6417	12.6347	11.7079	13.4350	13.5954	15.8442	17.2951	18.7814	(46)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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	14.0271	12.6533	13.9830	13.5024	13.9311	13.4570	13.8902	13.9167	13.4818	13.9615	13.5453	14.0185	(61)
Total heat required for water heating calculated for each month													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(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													
	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(64)
								Total per year (kWh/year) = Sum(64)m =				1411.3830	(64)
Heat gains from water heating, kWh/month													
	46.4953	40.7614	42.2935	37.2005	35.9385	31.3711	29.4250	33.2600	33.5070	38.6116	41.7239	45.1367	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	113.8272	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	41.5134	36.8719	29.9862	22.7015	16.9696	14.3265	15.4803	20.1218	27.0075	34.2922	40.0241	42.6672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	246.9412	249.5037	243.0463	229.2994	211.9463	195.6369	184.7412	182.1787	188.6361	202.3830	219.7361	236.0455	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	48.2798	(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)													
	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	-75.8848	(71)
Water heating gains (Table 5)													
	62.4937	60.6568	56.8462	51.6673	48.3045	43.5710	39.5498	44.7043	46.5374	51.8973	57.9498	60.6676	(72)
Total internal gains													
	440.1706	436.2546	419.1010	392.8905	366.4427	342.7566	328.9935	336.2271	351.4033	377.7948	406.9322	428.6026	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4200	11.9814	0.4500	0.0000	0.7700	26.6531	(74)

Solar gains	26.6531	46.2413	78.4165	130.3669	170.8487	195.3851	180.5989	146.8414	102.4689	59.0255	33.7711	21.9503	(83)
Total gains	466.8237	482.4959	497.5175	523.2574	537.2914	538.1417	509.5923	483.0685	453.8722	436.8203	440.7034	450.5530	(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	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	33.9946	
alpha	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	3.2663	
util living area													
	0.9050	0.8903	0.8487	0.7613	0.6125	0.4167	0.2803	0.3042	0.5459	0.7668	0.8703	0.9124	(86)
MIT	19.8718	19.9794	20.2504	20.5785	20.8448	20.9687	20.9940	20.9921	20.9200	20.6345	20.2125	19.8314	(87)
Th 2	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	20.2385	(88)
util rest of house													
	0.8941	0.8777	0.8308	0.7332	0.5688	0.3582	0.2128	0.2337	0.4866	0.7336	0.8533	0.9021	(89)
MIT 2	19.2178	19.3220	19.5832	19.8906	20.1258	20.2215	20.2365	20.2358	20.1889	19.9473	19.5502	19.1791	(90)
Living area fraction										fLA = Living area / (4) =		0.5216	(91)
MIT	19.5589	19.6649	19.9312	20.2494	20.5008	20.6113	20.6317	20.6303	20.5702	20.3058	19.8957	19.5194	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4089	19.5149	19.7812	20.0994	20.3508	20.4613	20.4817	20.4803	20.4202	20.1558	19.7457	19.3694	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8803	0.8641	0.8190	0.7277	0.5755	0.3756	0.2345	0.2563	0.5013	0.7297	0.8410	0.8885	(94)
Useful gains	410.9642	416.9355	407.4478	380.7798	309.1936	202.1528	119.5231	123.8260	227.5054	318.7376	370.6271	400.2940	(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													
	667.0387	648.6703	577.1744	475.4647	342.6738	207.9710	120.3494	124.9477	243.3516	398.8454	547.5466	665.1935	(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													
	190.5194	155.7258	126.2766	68.1731	24.9093	0.0000	0.0000	0.0000	0.0000	59.6002	127.3821	197.0852	(98)
Space heating												949.6717	(98)
Space heating per m2											(98) / (4) =	16.6463	(99)

8c. Space cooling requirement

Not applicable

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

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1049.3609	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	190.5194	155.7258	126.2766	68.1731	24.9093	0.0000	0.0000	0.0000	0.0000	59.6002	127.3821	197.0852	(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)	210.5187	172.0727	139.5322	75.3294	27.5241	0.0000	0.0000	0.0000	0.0000	65.8566	140.7537	217.7737	(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	143.3159	125.7301	130.6681	115.2314	111.5424	97.6882	91.9427	103.4832	104.1179	119.5892	128.8462	139.2278	(64)
Efficiency of water heater (217)m	89.0979	89.0420	88.8439	88.4627	87.8672	87.3000	87.3000	87.3000	87.3000	88.3389	88.8621	87.3000	(216)
												89.1472	(217)
Fuel for water heating, kWh/month	160.8521	141.2031	147.0761	130.2598	126.9444	111.8994	105.3181	118.5374	119.2645	135.3754	144.9957	156.1774	(219)

Water heating fuel used	1597.9034	(219)
Annual totals kWh/year		
Space heating fuel - main system	1049.3609	(211)
Space heating fuel - secondary	0.0000	(215)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)

mechanical ventilation fans (SFP = 0.1840)	30.7358	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	105.7358	(231)
Electricity for lighting (calculated in Appendix L)	293.2562	(232)
Total delivered energy for all uses	3046.2564	(238)

10a. Fuel costs - using BEDF prices (476)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1049.3609	3.8700	40.6103	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1597.9034	3.8700	61.8389	(247)
Mechanical ventilation fans	30.7358	18.9000	5.8091	(249)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Energy for lighting	293.2562	18.9000	55.4254	(250)
Additional standing charges			93.0000	(251)
Total energy cost			270.8586	(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	1049.3609	0.2160	226.6620	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1597.9034	0.2160	345.1471	(264)
Space and water heating			571.8091	(265)
Pumps and fans	105.7358	0.5190	54.8769	(267)
Energy for lighting	293.2562	0.5190	152.2000	(268)
Total kg/year			778.8860	(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	1049.3609	1.2200	1280.2203	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1597.9034	1.2200	1949.4422	(264)
Space and water heating			3229.6626	(265)
Pumps and fans	105.7358	3.0700	324.6089	(267)
Energy for lighting	293.2562	3.0700	900.2965	(268)
Primary energy kWh/year			4454.5680	(272)
Primary energy kWh/m2/year			78.0818	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
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)			

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

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 476 TEST (01 Apr 2021)
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	£75	£75	£0
Mains gas	£195	£195	£0
Space heating	£154	£154	£0
Water heating	£62	£62	£0
Lighting	£55	£55	£0
Total cost of fuels	£270	£270	£0
Total cost of uses	£271	£271	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	78 kWh/m²	78 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
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	271.10	(P1)
Transmission heat loss coefficient	24.03	(37)
Summer heat loss coefficient	295.13	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	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	6.4200	81.1852	0.4500	0.0000	0.9000	211.0896
total:						211.0896

	Jun	Jul	Aug	
Solar gains	228	211	172	(P4)
Internal gains	340	326	333	
Total summer gains	568	537	505	(P5)
Summer gain/loss ratio	1.93	1.82	1.71	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.23	21.02	20.81	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight