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

Property Reference	SECPMW026g_092_As_Built	**Issued on Date**	24/01/2022
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	86 B	**DER**	14.32	**TER**	15.59
Environmental	90 B	**% DER<TER**	8.16		
CO_2 Emissions (t/year)	0.85	**DFEE**	32.01	**TFEE**	34.51
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.24		

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

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

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 73 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) 15.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.32 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.0 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.33 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

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

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3 Air permeability
Air permeability at 50 pascals: 4.40 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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

Hot water controls: No cylinder

Boiler interlock Yes OK

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

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

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9 Summertime temperature
Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing West: 10.22 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.2200	(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) =	0.1705	(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	0.2174	0.2131	0.2089	0.1876	0.1833	0.1620	0.1620	0.1577	0.1705	0.1833	0.1918	0.2003	(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)			10.2200	1.2357	12.6293			(27)
WT-E-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.1250			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Party Ceilings 1			72.6200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6120	(36)
Total fabric heat loss (33) + (36) =	32.7370	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	(39)
Average = Sum(39)m / 12 =												61.4945	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	(40)
HLP (average)												0.8468	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(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	14.0978	12.7129	14.0421	13.5520	13.9767	13.4947	13.9251	13.9586	13.5259	14.0151	13.6061	14.0870	(61)
Total heat required for water heating calculated for each month													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(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													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
								Total per year (kWh/year) = Sum(64)m =				1565.5522	(64)
Heat gains from water heating, kWh/month													
	51.8061	45.4056	47.0855	41.3777	39.9462	34.8290	32.6292	36.9374	37.2287	42.9494	46.4595	50.2799	(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	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4252	17.2533	14.0313	10.6226	7.9405	6.7037	7.2436	9.4155	12.6375	16.0462	18.7283	19.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.3331	205.4431	200.1260	188.8067	174.5181	161.0888	152.1172	150.0072	155.3242	166.6436	180.9322	194.3615	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	(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)													
	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)													
	69.6318	67.5679	63.2869	57.4690	53.6911	48.3736	43.8565	49.6470	51.7065	57.7277	64.5271	67.5806	(72)
Total internal gains													
	353.0104	350.8845	338.0645	317.5185	296.7699	276.7863	263.8375	269.6899	280.2884	301.0377	324.8078	342.5274	(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	
West	10.2200	19.6403	0.4500	0.0000	0.7700	69.5507	(80)

Solar gains	69.5507	136.0559	224.0647	326.7850	400.4873	409.9700	390.3082	335.2689	260.5965	161.4418	86.7215	57.1951	(83)
Total gains	422.5611	486.9404	562.1292	644.3035	697.2572	686.7563	654.1457	604.9589	540.8850	462.4795	411.5294	399.7225	(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	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	
alpha	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	
util living area													
	0.9981	0.9948	0.9807	0.9198	0.7672	0.5663	0.4128	0.4658	0.7424	0.9627	0.9954	0.9987	(86)
MIT	20.1716	20.3078	20.5340	20.7927	20.9494	20.9936	20.9993	20.9985	20.9689	20.7340	20.3907	20.1323	(87)
Th 2	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	(88)
util rest of house													
	0.9975	0.9932	0.9746	0.8969	0.7176	0.4997	0.3394	0.3871	0.6734	0.9470	0.9936	0.9983	(89)
MIT 2	19.4504	19.5860	19.8085	20.0517	20.1812	20.2102	20.2128	20.2125	20.1970	20.0033	19.6689	19.4112	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.7061	19.8419	20.0658	20.3144	20.4536	20.4880	20.4917	20.4912	20.4707	20.2624	19.9248	19.6669	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5561	19.6919	19.9158	20.1644	20.3036	20.3380	20.3417	20.3412	20.3207	20.1124	19.7748	19.5169	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9918	0.9717	0.8953	0.7236	0.5104	0.3515	0.4000	0.6834	0.9446	0.9923	0.9977	(94)
Useful gains	421.2218	482.9260	546.2415	576.8456	504.5413	350.5263	229.9179	241.9711	369.6463	436.8545	408.3802	398.8205	(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													
	938.1695	909.6227	824.9982	692.7009	529.0764	352.8547	230.0913	242.3633	382.5379	584.9600	779.4324	941.9062	(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													
	384.6091	286.7402	207.3950	83.4158	18.2541	0.0000	0.0000	0.0000	0.0000	110.1905	267.1576	404.0558	(98)
Space heating												1761.8180	(98)
Space heating per m2											(98) / (4) =	24.2608	(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	1946.7603	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	384.6091	286.7402	207.3950	83.4158	18.2541	0.0000	0.0000	0.0000	0.0000	110.1905	267.1576	404.0558	(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)	424.9824	316.8400	229.1657	92.1721	20.1703	0.0000	0.0000	0.0000	0.0000	121.7575	295.2017	446.4705	(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	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5387	89.4261	89.1548	88.5363	87.6990	87.3000	87.3000	87.3000	87.3000	88.7235	89.3575	89.5907	(217)
Fuel for water heating, kWh/month	177.9182	156.2325	162.7445	144.3551	140.9443	123.8226	116.3667	131.2179	132.0985	149.5077	160.1475	172.6888	(219)

Water heating fuel used	1768.0443	(219)
Annual totals kWh/year		
Space heating fuel - main system	1946.7603	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	39.1242	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1242	(231)
Electricity for lighting (calculated in Appendix L)	343.0552	(232)
Total delivered energy for all uses	4171.9839	(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	1946.7603	0.2160	420.5002	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1768.0443	0.2160	381.8976	(264)
Space and water heating			802.3978	(265)
Pumps and fans	114.1242	0.5190	59.2304	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total CO2, kg/year			1039.6739	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3200	(273)

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

DER		14.3200	ZC1
Total Floor Area	TFA	72.6200	
Assumed number of occupants	N	2.3080	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5920	ZC2
CO2 emissions from cooking, equation (L16)		2.4014	ZC3
Total CO2 emissions		33.3134	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		33.3134	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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1721	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4221	(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) =	0.3271	(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	0.4171	0.4089	0.4008	0.3599	0.3517	0.3108	0.3108	0.3026	0.3271	0.3517	0.3680	0.3844	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739	(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)			10.2200	1.3258	13.5492			(27)
WT-E-02	28.3400	10.2200	18.1200	0.1800	3.2616			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.1800	4.2282			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1590			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5327	(36)
Total fabric heat loss					(33) + (36) =		28.6917	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.7609	33.5666	33.3762	32.4817	32.3143	31.5353	31.5353	31.3910	31.8354	32.3143	32.6529	33.0069	(38)
Heat transfer coeff	62.4527	62.2584	62.0679	61.1734	61.0061	60.2270	60.2270	60.0827	60.5271	61.0061	61.3446	61.6986	(39)
Average = Sum(39)m / 12 =												61.1726	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8600	0.8573	0.8547	0.8424	0.8401	0.8293	0.8293	0.8274	0.8335	0.8401	0.8447	0.8496	(40)
HLP (average)												0.8424	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	49.8974	43.4297	46.2685	43.0200	42.6396	39.5082	40.8251	42.6396	43.0200	46.2685	46.5319	49.8974	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month	195.1053	170.4295	177.3209	157.2747	152.2696	134.1106	128.4882	143.2342	144.8161	164.9019	176.0296	190.5235	(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	195.1053	170.4295	177.3209	157.2747	152.2696	134.1106	128.4882	143.2342	144.8161	164.9019	176.0296	190.5235	(64)
								Total per year (kWh/year) = Sum(64)m =				1934.5041	(64)
Heat gains from water heating, kWh/month	60.7560	53.0849	55.1420	48.7447	47.1119	41.3323	39.3542	44.1076	44.6022	51.0127	54.6910	59.2325	(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	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.4252	17.2533	14.0313	10.6226	7.9405	6.7037	7.2436	9.4155	12.6375	16.0462	18.7283	19.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.3331	205.4431	200.1260	188.8067	174.5181	161.0888	152.1172	150.0072	155.3242	166.6436	180.9322	194.3615	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	(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)	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)	81.6613	78.9953	74.1156	67.7009	63.3224	57.4060	52.8955	59.2844	61.9475	68.5655	75.9597	79.6136	(72)
Total internal gains	365.0398	362.3119	348.8932	327.7505	306.4013	285.8188	272.8765	279.3274	290.5295	311.8755	336.2404	354.5604	(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	
West	10.2200	19.6403	0.6300	0.7000	0.7700	61.3437	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	61.3437	120.0013	197.6251	288.2244	353.2298	361.5935	344.2518	295.7072	229.8461	142.3917	76.4884	50.4461	(83)
Total gains	426.3835	482.3132	546.5183	615.9749	659.6310	647.4123	617.1283	575.0346	520.3756	454.2672	412.7288	405.0065	(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	80.7500	81.0020	81.2506	82.4386	82.6648	83.7341	83.7341	83.9352	83.3190	82.6648	82.2086	81.7370	
alpha	6.3833	6.4001	6.4167	6.4959	6.5110	6.5823	6.5823	6.5957	6.5546	6.5110	6.4806	6.4491	
util living area	0.9980	0.9952	0.9836	0.9319	0.7935	0.5873	0.4285	0.4786	0.7563	0.9649	0.9953	0.9986	(86)
MIT	20.1570	20.2864	20.5046	20.7724	20.9398	20.9928	20.9992	20.9984	20.9670	20.7312	20.3949	20.1352	(87)
Th 2	20.2016	20.2039	20.2062	20.2168	20.2187	20.2280	20.2280	20.2297	20.2244	20.2187	20.2147	20.2105	(88)
util rest of house	0.9974	0.9936	0.9783	0.9115	0.7454	0.5200	0.3538	0.3996	0.6883	0.9500	0.9935	0.9981	(89)
MIT 2	19.0661	19.2564	19.5735	19.9543	20.1625	20.2233	20.2277	20.2290	20.1993	19.9071	19.4236	19.0412	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.4529	19.6216	19.9036	20.2444	20.4381	20.4962	20.5012	20.5018	20.4715	20.1993	19.7680	19.4291	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4529	19.6216	19.9036	20.2444	20.4381	20.4962	20.5012	20.5018	20.4715	20.1993	19.7680	19.4291	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9922	0.9758	0.9123	0.7596	0.5437	0.3803	0.4277	0.7110	0.9496	0.9922	0.9975	(94)
Useful gains	424.9357	478.5275	533.2832	561.9667	501.0617	351.9991	234.7074	245.9221	370.0127	431.3727	409.4959	403.9919	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	946.3408	916.5455	831.9369	693.9730	533.0786	355.1097	234.9602	246.4499	385.6473	585.6164	777.1120	939.6140	(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	387.9254	294.3481	222.1983	95.0446	23.8206	0.0000	0.0000	0.0000	0.0000	114.7574	264.6836	398.5028	(98)
Space heating												1801.2807	(98)
Space heating per m2											(98) / (4) =	24.8042	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1928.5660	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	387.9254	294.3481	222.1983	95.0446	23.8206	0.0000	0.0000	0.0000	0.0000	114.7574	264.6836	398.5028	(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)	415.3377	315.1479	237.8997	101.7608	25.5038	0.0000	0.0000	0.0000	0.0000	122.8665	283.3872	426.6625	(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	195.1053	170.4295	177.3209	157.2747	152.2696	134.1106	128.4882	143.2342	144.8161	164.9019	176.0296	190.5235	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.7487	86.4144	85.6203	83.8279	81.5323	80.3000	80.3000	80.3000	80.3000	84.1583	86.0757	86.8660	(217)
Fuel for water heating, kWh/month	224.9086	197.2235	207.1015	187.6161	186.7600	167.0120	160.0102	178.3738	180.3438	195.9425	204.5055	219.3304	(219)
Water heating fuel used												2309.1279	(219)
Annual totals kWh/year													
Space heating fuel - main system												1928.5660	(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)	343.0552	(232)
Total delivered energy for all uses	4655.7491	(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	1928.5660	0.2160	416.5703	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2309.1279	0.2160	498.7716	(264)
Space and water heating			915.3419	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total CO2, kg/m2/year			1132.3125	(272)
Emissions per m2 for space and water heating			12.6045	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4517	(272b)
Emissions per m2 for pumps and fans			0.5360	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6045 * 1.00) + 2.4517 + 0.5360, rounded to 2 d.p.			15.5900	(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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1721	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.3921	(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) =	0.3039	(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	0.3875	0.3799	0.3723	0.3343	0.3267	0.2887	0.2887	0.2811	0.3039	0.3267	0.3419	0.3571	(22b)
Effective ac	0.5751	0.5722	0.5693	0.5559	0.5534	0.5417	0.5417	0.5395	0.5462	0.5534	0.5584	0.5638	(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)			10.2200	1.2357	12.6293			(27)
WT-E-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.1250			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Party Ceilings 1			72.6200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6120	(36)
Total fabric heat loss (33) + (36) =	32.7370	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.0750	32.9074	32.7430	31.9712	31.8268	31.1545	31.1545	31.0300	31.4134	31.8268	32.1189	32.4243	(38)
Heat transfer coeff	65.8120	65.6444	65.4801	64.7082	64.5638	63.8915	63.8915	63.7670	64.1504	64.5638	64.8559	65.1613	(39)
Average = Sum(39)m / 12 =												64.7075	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9063	0.9039	0.9017	0.8911	0.8891	0.8798	0.8798	0.8781	0.8834	0.8891	0.8931	0.8973	(40)
HLP (average)												0.8910	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.8567	26.9875	27.8486	24.2791	23.2964	20.1030	18.6284	21.3764	21.6317	25.2096	27.5183	29.8831	(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	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	115.4008	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.4252	17.2533	14.0313	10.6226	7.9405	6.7037	7.2436	9.4155	12.6375	16.0462	18.7283	19.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.3331	205.4431	200.1260	188.8067	174.5181	161.0888	152.1172	150.0072	155.3242	166.6436	180.9322	194.3615	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	34.5401	(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)	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)	41.4740	40.1599	37.4310	33.7210	31.3124	27.9209	25.0382	28.7317	30.0440	33.8839	38.2198	40.1654	(72)
Total internal gains	321.8526	320.4765	309.2085	290.7705	271.3912	253.3336	242.0192	245.7746	255.6259	274.1939	295.5005	312.1122	(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	
West	10.2200	19.6403	0.4500	0.0000	0.7700	69.5507	(80)

Solar gains	69.5507	136.0559	224.0647	326.7850	400.4873	409.9700	390.3082	335.2689	260.5965	161.4418	86.7215	57.1951	(83)
Total gains	391.4033	456.5324	533.2732	617.5555	671.8785	663.3036	632.3273	581.0436	516.2225	435.6357	382.2221	369.3073	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	76.6282	76.8239	77.0167	77.9354	78.1097	78.9316	78.9316	79.0857	78.6130	78.1097	77.7578	77.3934	
alpha	6.1085	6.1216	6.1344	6.1957	6.2073	6.2621	6.2621	6.2724	6.2409	6.2073	6.1839	6.1596	
util living area	0.9988	0.9967	0.9871	0.9407	0.8085	0.6047	0.4430	0.5014	0.7878	0.9749	0.9971	0.9992	(86)
MIT	20.0417	20.1851	20.4269	20.7258	20.9223	20.9894	20.9987	20.9973	20.9511	20.6650	20.2940	20.0162	(87)
Th 2	20.1622	20.1641	20.1661	20.1751	20.1768	20.1847	20.1847	20.1862	20.1817	20.1768	20.1734	20.1698	(88)
util rest of house	0.9984	0.9956	0.9827	0.9218	0.7598	0.5328	0.3618	0.4145	0.7187	0.9635	0.9960	0.9989	(89)
MIT 2	19.2783	19.4229	19.6638	19.9575	20.1268	20.1800	20.1844	20.1854	20.1557	19.9072	19.5395	19.2592	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.5490	19.6932	19.9344	20.2299	20.4089	20.4670	20.4731	20.4733	20.4377	20.1759	19.8070	19.5276	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5490	19.6932	19.9344	20.2299	20.4089	20.4670	20.4731	20.4733	20.4377	20.1759	19.8070	19.5276	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9948	0.9812	0.9232	0.7744	0.5581	0.3907	0.4454	0.7418	0.9634	0.9953	0.9986	(94)
Useful gains	390.6437	454.1386	523.2475	570.1225	520.2732	370.2059	247.0345	258.8168	382.9104	419.7127	380.4439	368.7994	(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	1003.5660	971.0873	879.6845	733.1375	562.2789	374.8519	247.4581	259.7399	406.5675	618.2542	824.1273	998.7682	(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	456.0142	347.3895	265.1892	117.3708	31.2523	0.0000	0.0000	0.0000	0.0000	147.7149	319.4520	468.6968	(98)
Space heating												2153.0797	(98)
Space heating per m2											(98) / (4) =	29.6486	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	600.5800	472.7970	484.6292	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9659	0.9866	0.9783	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	580.1053	466.4570	474.1336	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	861.6133	823.7085	765.3510	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	202.6857	265.7951	216.6658	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												685.1466	(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	50.6714	66.4488	54.1664	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												171.2866	(107)
Space cooling per m2												2.3587	(108)
Energy for space heating												29.6486	(99)
Energy for space cooling												2.3587	(108)
Total												32.0072	(109)
Dwelling Fabric Energy Efficiency (DFEE)												32.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1721	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4221	(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) =	0.3271	(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	0.4171	0.4089	0.4008	0.3599	0.3517	0.3108	0.3108	0.3026	0.3271	0.3517	0.3680	0.3844	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739	(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)			10.2200	1.3258	13.5492			(27)
WT-E-02	28.3400	10.2200	18.1200	0.1800	3.2616			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.1800	4.2282			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1590			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5327	(36)
Total fabric heat loss					(33) + (36) =		28.6917	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.7609	33.5666	33.3762	32.4817	32.3143	31.5353	31.5353	31.3910	31.8354	32.3143	32.6529	33.0069	(38)
Heat transfer coeff	62.4527	62.2584	62.0679	61.1734	61.0061	60.2270	60.2270	60.0827	60.5271	61.0061	61.3446	61.6986	(39)
Average = Sum(39)m / 12 =												61.1726	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8600	0.8573	0.8547	0.8424	0.8401	0.8293	0.8293	0.8274	0.8335	0.8401	0.8447	0.8496	(40)
HLP (average)												0.8424	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Heat gains from water heating, kWh/month
                30.8567    26.9875    27.8486    24.2791    23.2964    20.1030    18.6284    21.3764    21.6317    25.2096    27.5183    29.8831 (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          115.4008   115.4008   115.4008   115.4008   115.4008   115.4008   115.4008   115.4008   115.4008   115.4008   115.4008   115.4008 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                19.4252    17.2533    14.0313    10.6226     7.9405     6.7037     7.2436     9.4155    12.6375    16.0462    18.7283    19.9651 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               203.3331   205.4431   200.1260   188.8067   174.5181   161.0888   152.1172   150.0072   155.3242   166.6436   180.9322   194.3615 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                34.5401    34.5401    34.5401    34.5401    34.5401    34.5401    34.5401    34.5401    34.5401    34.5401    34.5401    34.5401 (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)
               -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206 (71)
Water heating gains (Table 5)
                41.4740    40.1599    37.4310    33.7210    31.3124    27.9209    25.0382    28.7317    30.0440    33.8839    38.2198    40.1654 (72)
Total internal gains
               321.8526   320.4765   309.2085   290.7705   271.3912   253.3336   242.0192   245.7746   255.6259   274.1939   295.5005   312.1122 (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
-----------------------------------------------------------------------------------------------------------------------------------
West                                     10.2200          19.6403          0.6300           0.7000          0.7700          61.3437 (80)
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Solar gains     61.3437   120.0013   197.6251   288.2244   353.2298   361.5935   344.2518   295.7072   229.8461   142.3917    76.4884    50.4461 (83)
Total gains    383.1963   440.4778   506.8336   578.9949   624.6210   614.9271   586.2710   541.4818   485.4721   416.5856   371.9889   362.5583 (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            80.7500    81.0020    81.2506    82.4386    82.6648    83.7341    83.7341    83.9352    83.3190    82.6648    82.2086    81.7370
alpha           6.3833     6.4001     6.4167     6.4959     6.5110     6.5823     6.5823     6.5957     6.5546     6.5110     6.4806     6.4491
util living area
                0.9989     0.9971     0.9889     0.9475     0.8218     0.6157     0.4507     0.5074     0.7943     0.9768     0.9974     0.9993 (86)

MIT            20.0986    20.2307    20.4549    20.7375    20.9259    20.9906    20.9989    20.9978    20.9560    20.6881    20.3404    20.0776 (87)
Th 2           20.2016    20.2039    20.2062    20.2168    20.2187    20.2280    20.2280    20.2297    20.2244    20.2187    20.2147    20.2105 (88)
util rest of house
                0.9986     0.9961     0.9851     0.9305     0.7756     0.5463     0.3723     0.4241     0.7281     0.9663     0.9964     0.9990 (89)
MIT 2          19.3682    19.5017    19.7259    20.0065    20.1705    20.2238    20.2277    20.2290    20.2008    19.9662    19.6206    19.3546 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.3546 (91)
MIT            19.6272    19.7602    19.9844    20.2657    20.4383    20.4957    20.5012    20.5016    20.4686    20.2222    19.8758    19.6110 (92)
Temperature adjustment                                                                                                           0.0000
adjusted MIT   19.6272    19.7602    19.9844    20.2657    20.4383    20.4957    20.5012    20.5016    20.4686    20.2222    19.8758    19.6110 (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     0.9983     0.9954     0.9838     0.9318     0.7894     0.5708     0.4002     0.4537     0.7503     0.9663     0.9958     0.9988 (94)
Useful gains  382.5297   438.4724   498.6355   539.4801   493.0789   350.9759   234.6123   245.6884   364.2483   402.5509   370.4211   362.1108 (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
               957.2225   925.1723   836.9479   695.2776   533.0916   355.0795   234.9551   246.4369   385.4730   587.0107   783.7278   950.8347 (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
               427.5715   327.0624   251.7045   112.1741    29.7695     0.0000     0.0000     0.0000     0.0000   137.2381   297.5808   438.0106 (98)
Space heating                                                                                                                   2021.1114 (98)
Space heating per m2                                                                                                 (98) / (4) =     27.8313 (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   566.1339   445.6798   456.6288     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation     0.0000     0.0000     0.0000     0.0000     0.0000     0.9686     0.9883     0.9811     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss     0.0000     0.0000     0.0000     0.0000     0.0000   548.3502   440.4591   448.0188     0.0000     0.0000     0.0000     0.0000 (102)
Total gains     0.0000     0.0000     0.0000     0.0000     0.0000   805.0694   769.8764   719.1100     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   184.8378   245.0864   201.6919     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                   631.6162 (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
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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	46.2095	61.2716	50.4230	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												157.9040	(107)
Space cooling per m2												2.1744	(108)
Energy for space heating												27.8313	(99)
Energy for space cooling												2.1744	(108)
Total												30.0057	(109)
Target Fabric Energy Efficiency (TFEE)												34.5	(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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		174.2880	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.2200	(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) =	0.1705	(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	0.1790	0.1705	0.1705	0.1577	0.1577	0.1407	0.1449	0.1364	0.1407	0.1492	0.1492	0.1620	(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)			10.2200	1.2357	12.6293			(27)
WT-E-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.1250			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Party Ceilings 1			72.6200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6120	(36)
Total fabric heat loss (33) + (36) =	32.7370	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	(39)
Average = Sum(39)m / 12 =												61.4945	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	(40)
HLP (average)												0.8468	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(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     14.0978   12.7129   14.0421   13.5520   13.9767   13.4947   13.9251   13.9586   13.5259   14.0151   13.6061   14.0870 (61)
Total heat required for water heating calculated for each month
              159.3057  139.7127  145.0945  127.8067  123.6068  108.0971  101.5882  114.5532  115.3220  132.6485  143.1038  154.7132 (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
              159.3057  139.7127  145.0945  127.8067  123.6068  108.0971  101.5882  114.5532  115.3220  132.6485  143.1038  154.7132 (64)
                                                                                        Total per year (kWh/year) = Sum(64)m =   1565.5522 (64)
RHI water heating demand                                                                                                          1566 (64)
Heat gains from water heating, kWh/month
               51.8061   45.4056   47.0855   41.3777   39.9462   34.8290   32.6292   36.9374   37.2287   42.9494   46.4595   50.2799 (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         138.4809  138.4809  138.4809  138.4809  138.4809  138.4809  138.4809  138.4809  138.4809  138.4809  138.4809  138.4809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               48.5630   43.1332   35.0783   26.5565   19.8513   16.7593   18.1090   23.5388   31.5937   40.1155   46.8207   49.9127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              303.4822  306.6314  298.6956  281.8010  260.4747  240.4310  227.0406  223.8914  231.8272  248.7218  270.0481  290.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               51.1561   51.1561   51.1561   51.1561   51.1561   51.1561   51.1561   51.1561   51.1561   51.1561   51.1561   51.1561 (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)
              -92.3206  -92.3206  -92.3206  -92.3206  -92.3206  -92.3206  -92.3206  -92.3206  -92.3206  -92.3206  -92.3206  -92.3206 (71)
Water heating gains (Table 5)
               69.6318   67.5679   63.2869   57.4690   53.6911   48.3736   43.8565   49.6470   51.7065   57.7277   64.5271   67.5806 (72)
Total internal gains
              521.9935  517.6490  497.3772  466.1430  434.3335  405.8803  389.3225  397.3936  415.4439  446.8814  481.7123  507.9015 (73)


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6. Solar gains
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[Jan]                                     Area        Solar flux              g                FF           Access            Gains
                                           m2          Table 6a      Specific data      Specific data        factor              W
                                                          W/m2        or Table 6b        or Table 6c       Table 6d
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West                                    10.2200          22.3313           0.4500            0.0000           0.7700          79.0803 (80)
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Solar gains    79.0803  139.1533  225.9604  338.6498  403.5155  441.7215  416.1196  366.0865  284.5456  176.2051  101.0154   64.4008 (83)
Total gains   601.0738  656.8023  723.3375  804.7928  837.8491  847.6018  805.4421  763.4801  699.9894  623.0865  582.7277  572.3023 (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            82.0082   82.0082   82.0082   82.0082   82.0082   82.0082   82.0082   82.0082   82.0082   82.0082   82.0082   82.0082
alpha           6.4672    6.4672    6.4672    6.4672    6.4672    6.4672    6.4672    6.4672    6.4672    6.4672    6.4672    6.4672
util living area
                0.9830    0.9693    0.9201    0.7854    0.5793    0.3624    0.2367    0.2577    0.5063    0.8315    0.9613    0.9868 (86)

MIT            20.4704   20.5751   20.7663   20.9309   20.9909   20.9996   21.0000   21.0000   20.9969   20.9179   20.6725   20.4346 (87)
Th 2           20.2130   20.2130   20.2130   20.2130   20.2130   20.2130   20.2130   20.2130   20.2130   20.2130   20.2130   20.2130 (88)
util rest of house
                0.9781    0.9608    0.9001    0.7450    0.5253    0.3056    0.1766    0.1943    0.4392    0.7866    0.9489    0.9828 (89)
MIT 2          19.7455   19.8467   20.0256   20.1655   20.2082   20.2128   20.2130   20.2130   20.2118   20.1589   19.9418   19.7107 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.3546 (91)
MIT            20.0025   20.1050   20.2883   20.4369   20.4858   20.4918   20.4920   20.4920   20.4902   20.4280   20.2009   19.9674 (92)
Temperature adjustment                                                                                                         -0.1500
adjusted MIT   19.8525   19.9550   20.1383   20.2869   20.3358   20.3418   20.3420   20.3420   20.3402   20.2780   20.0509   19.8174 (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     0.9753    0.9575    0.8980    0.7490    0.5338    0.3149    0.1864    0.2047    0.4501    0.7906    0.9459    0.9804 (94)
Useful gains  586.2313  628.8914  649.5455  602.7638  447.2741  266.8941  150.1687  156.3158  315.0765  492.6318  551.1784  561.0765 (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
              907.2010  882.7527  783.3331  638.7385  451.1103  266.9983  150.1711  156.3202  316.0930  533.6503  741.0637  905.0412 (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
              238.8014  170.5948   99.5380   25.9018    2.8541    0.0000    0.0000    0.0000    0.0000   30.5177  136.7174  255.9097 (98)
Space heating                                                                                                                960.8349 (98)
RHI space heating demand                                                                                                         961 (98)


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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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.2200	(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) =	0.1705	(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	0.2174	0.2131	0.2089	0.1876	0.1833	0.1620	0.1620	0.1577	0.1705	0.1833	0.1918	0.2003	(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)			10.2200	1.2357	12.6293			(27)
WT-E-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.1250			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Party Ceilings 1			72.6200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6120	(36)
Total fabric heat loss (33) + (36) =	32.7370	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	(39)

Average = Sum(39)m / 12 = 61.4945 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	(40)
HLP (average)												0.8468	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0978	12.7129	14.0421	13.5520	13.9767	13.4947	13.9251	13.9586	13.5259	14.0151	13.6061	14.0870	(61)
Total heat required for water heating calculated for each month													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(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													
	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
								Total per year (kWh/year) = Sum(64)m =				1565.5522	(64)
Heat gains from water heating, kWh/month													
	51.8061	45.4056	47.0855	41.3777	39.9462	34.8290	32.6292	36.9374	37.2287	42.9494	46.4595	50.2799	(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	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	138.4809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.5630	43.1332	35.0783	26.5565	19.8513	16.7593	18.1090	23.5388	31.5937	40.1155	46.8207	49.9127	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	303.4822	306.6314	298.6956	281.8010	260.4747	240.4310	227.0406	223.8914	231.8272	248.7218	270.0481	290.0918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	51.1561	(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)													
	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	-92.3206	(71)
Water heating gains (Table 5)													
	69.6318	67.5679	63.2869	57.4690	53.6911	48.3736	43.8565	49.6470	51.7065	57.7277	64.5271	67.5806	(72)
Total internal gains													
	521.9935	517.6490	497.3772	466.1430	434.3335	405.8803	389.3225	397.3936	415.4439	446.8814	481.7123	507.9015	(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	
West	10.2200	19.6403	0.4500	0.0000	0.7700	69.5507	(80)

Solar gains	69.5507	136.0559	224.0647	326.7850	400.4873	409.9700	390.3082	335.2689	260.5965	161.4418	86.7215	57.1951	(83)
Total gains	591.5442	653.7049	721.4419	792.9280	834.8208	815.8503	779.6307	732.6625	676.0404	608.3232	568.4338	565.0966	(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	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	82.0082	
alpha	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	6.4672	
util living area													
	0.9878	0.9757	0.9389	0.8370	0.6652	0.4802	0.3468	0.3856	0.6158	0.8867	0.9749	0.9907	(86)
MIT	20.3941	20.5179	20.7067	20.8900	20.9773	20.9975	20.9997	20.9995	20.9890	20.8630	20.5885	20.3522	(87)
Th 2	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	20.2130	(88)
util rest of house													
	0.9844	0.9691	0.9235	0.8033	0.6153	0.4221	0.2849	0.3199	0.5504	0.8534	0.9668	0.9881	(89)
MIT 2	19.6705	19.7912	19.9706	20.1326	20.1995	20.2119	20.2129	20.2128	20.2078	20.1144	19.8614	19.6293	(90)
Living area fraction									fLA = Living area / (4) =			0.3546	(91)
MIT	19.9271	20.0488	20.2316	20.4011	20.4753	20.4905	20.4919	20.4918	20.4848	20.3798	20.1192	19.8857	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7771	19.8988	20.0816	20.2511	20.3253	20.3405	20.3419	20.3418	20.3348	20.2298	19.9692	19.7357	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9820	0.9660	0.9205	0.8051	0.6226	0.4316	0.2951	0.3307	0.5608	0.8542	0.9638	0.9860	(94)
Useful gains	580.9045	631.4571	664.1096	638.3663	519.7544	352.1170	230.0456	242.2700	379.1061	519.6016	547.8535	557.2044	(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													
	951.7582	922.3460	835.1948	698.0336	530.4077	353.0072	230.1063	242.3969	383.4052	592.1802	791.3874	955.3581	(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													
	275.9152	195.4774	127.2873	42.9604	7.9261	0.0000	0.0000	0.0000	0.0000	53.9985	175.3444	296.2264	(98)
Space heating												1175.1357	(98)
Space heating per m2											(98) / (4) =	16.1820	(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	1298.4925	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	275.9152	195.4774	127.2873	42.9604	7.9261	0.0000	0.0000	0.0000	0.0000	53.9985	175.3444	296.2264	(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)	304.8786	215.9971	140.6490	47.4701	8.7581	0.0000	0.0000	0.0000	0.0000	59.6669	193.7507	327.3220	(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	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.3018	89.1381	88.7668	88.0835	87.4864	87.3000	87.3000	87.3000	87.3000	88.2023	89.0334	89.3760	(217)
Fuel for water heating, kWh/month	178.3902	156.7373	163.4559	145.0971	141.2868	123.8226	116.3667	131.2179	132.0985	150.3913	160.7304	173.1037	(219)
Water heating fuel used												1772.6984	(219)

Annual totals kWh/year		
Space heating fuel - main system	1298.4925	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)	39.1242	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1242	(231)
Electricity for lighting (calculated in Appendix L)	343.0552	(232)
Total delivered energy for all uses	3528.3702	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1298.4925	3.4800	45.1875	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1772.6984	3.4800	61.6899	(247)
Mechanical ventilation fans	39.1242	13.1900	5.1605	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	343.0552	13.1900	45.2490	(250)
Additional standing charges			120.0000	(251)
Total energy cost			287.1794	(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] =	1.0255	(257)
SAP value	85.6947	
SAP rating (Section 12)	86	(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	1298.4925	0.2160	280.4744	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1772.6984	0.2160	382.9028	(264)
Space and water heating			663.3772	(265)
Pumps and fans	114.1242	0.5190	59.2304	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total kg/year			900.6533	(272)
CO2 emissions per m2			12.4000	(273)
EI value			89.7392	
EI rating			90	(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 / 0.8822 = 3.945, stars = 4
Water heating environmental impact	0.216 / 0.8822 = 0.2449, 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	72.6200 (1b)	x	2.4000 (2b)	=	174.2880	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.2880	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.2200	(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) =	0.1705	(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	0.1790	0.1705	0.1705	0.1577	0.1577	0.1407	0.1449	0.1364	0.1407	0.1492	0.1492	0.1620	(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)			10.2200	1.2357	12.6293			(27)
WT-E-02	28.3400	10.2200	18.1200	0.2000	3.6240			(29a)
WT-I-01	25.6100	2.1200	23.4900	0.3300	7.7517			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.1250			(33)
Party Wall 1			31.6800	0.0000	0.0000			(32)
Party Floor 1			72.6200					(32d)
Party Ceilings 1			72.6200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6120	(36)
Total fabric heat loss (33) + (36) =	32.7370	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	28.7575	(38)
Heat transfer coeff	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	61.4945	(39)
Average = Sum(39)m / 12 =												61.4945	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	0.8468	(40)
HLP (average)												0.8468	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3080	(42)
Average daily hot water use (litres/day)	89.0154	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9169	94.3563	90.7957	87.2351	83.6744	80.1138	80.1138	83.6744	87.2351	90.7957	94.3563	97.9169	(44)
Energy conte	145.2079	126.9998	131.0524	114.2547	109.6301	94.6024	87.6630	100.5946	101.7960	118.6335	129.4977	140.6261	(45)
Energy content (annual)										Total = Sum(45)m =		1400.5582	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7812	19.0500	19.6579	17.1382	16.4445	14.1904	13.1495	15.0892	15.2694	17.7950	19.4247	21.0939	(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     14.0978    12.7129    14.0421    13.5520    13.9767    13.4947    13.9251    13.9586    13.5259    14.0151    13.6061    14.0870 (61)
Total heat required for water heating calculated for each month
              159.3057   139.7127   145.0945   127.8067   123.6068   108.0971   101.5882   114.5532   115.3220   132.6485   143.1038   154.7132 (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
              159.3057   139.7127   145.0945   127.8067   123.6068   108.0971   101.5882   114.5532   115.3220   132.6485   143.1038   154.7132 (64)
                                                                                                 Total per year (kWh/year) = Sum(64)m =   1565.5522 (64)
Heat gains from water heating, kWh/month
               51.8061    45.4056    47.0855    41.3777    39.9462    34.8290    32.6292    36.9374    37.2287    42.9494    46.4595    50.2799 (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         138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809   138.4809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               48.5630    43.1332    35.0783    26.5565    19.8513    16.7593    18.1090    23.5388    31.5937    40.1155    46.8207    49.9127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              303.4822   306.6314   298.6956   281.8010   260.4747   240.4310   227.0406   223.8914   231.8272   248.7218   270.0481   290.0918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561    51.1561 (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)
              -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206   -92.3206 (71)
Water heating gains (Table 5)
               69.6318    67.5679    63.2869    57.4690    53.6911    48.3736    43.8565    49.6470    51.7065    57.7277    64.5271    67.5806 (72)
Total internal gains
              521.9935   517.6490   497.3772   466.1430   434.3335   405.8803   389.3225   397.3936   415.4439   446.8814   481.7123   507.9015 (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
---------------------------------------------------------------------------------------------------------------------------------
West                                     10.2200          22.3313          0.4500          0.0000          0.7700          79.0803 (80)
---------------------------------------------------------------------------------------------------------------------------------

Solar gains    79.0803   139.1533   225.9604   338.6498   403.5155   441.7215   416.1196   366.0865   284.5456   176.2051   101.0154    64.4008 (83)
Total gains   601.0738   656.8023   723.3375   804.7928   837.8491   847.6018   805.4421   763.4801   699.9894   623.0865   582.7277   572.3023 (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            82.0082    82.0082    82.0082    82.0082    82.0082    82.0082    82.0082    82.0082    82.0082    82.0082    82.0082    82.0082
alpha           6.4672     6.4672     6.4672     6.4672     6.4672     6.4672     6.4672     6.4672     6.4672     6.4672     6.4672     6.4672
util living area
                0.9830     0.9693     0.9201     0.7854     0.5793     0.3624     0.2367     0.2577     0.5063     0.8315     0.9613     0.9868 (86)

MIT            20.4704    20.5751    20.7663    20.9309    20.9909    20.9996    21.0000    21.0000    20.9969    20.9179    20.6725    20.4346 (87)
Th 2           20.2130    20.2130    20.2130    20.2130    20.2130    20.2130    20.2130    20.2130    20.2130    20.2130    20.2130    20.2130 (88)
util rest of house
                0.9781     0.9608     0.9001     0.7450     0.5253     0.3056     0.1766     0.1943     0.4392     0.7866     0.9489     0.9828 (89)
MIT 2          19.7455    19.8467    20.0256    20.1655    20.2082    20.2128    20.2130    20.2130    20.2118    20.1589    19.9418    19.7107 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.3546 (91)
MIT            20.0025    20.1050    20.2883    20.4369    20.4858    20.4918    20.4920    20.4920    20.4902    20.4280    20.2009    19.9674 (92)
Temperature adjustment                                                                                                           -0.1500
adjusted MIT   19.8525    19.9550    20.1383    20.2869    20.3358    20.3418    20.3420    20.3420    20.3402    20.2780    20.0509    19.8174 (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     0.9753     0.9575     0.8980     0.7490     0.5338     0.3149     0.1864     0.2047     0.4501     0.7906     0.9459     0.9804 (94)
Useful gains  586.2313   628.8914   649.5455   602.7638   447.2741   266.8941   150.1687   156.3158   315.0765   492.6318   551.1784   561.0765 (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
              907.2010   882.7527   783.3331   638.7385   451.1103   266.9983   150.1711   156.3202   316.0930   533.6503   741.0637   905.0412 (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
              238.8014   170.5948    99.5380    25.9018     2.8541     0.0000     0.0000     0.0000     0.0000    30.5177   136.7174   255.9097 (98)
Space heating                                                                                                                     960.8349 (98)
Space heating per m2                                                                                                 (98) / (4) =     13.2310 (99)


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

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1061.6961	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	238.8014	170.5948	99.5380	25.9018	2.8541	0.0000	0.0000	0.0000	0.0000	30.5177	136.7174	255.9097	(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)	263.8690	188.5025	109.9867	28.6207	3.1537	0.0000	0.0000	0.0000	0.0000	33.7212	151.0690	282.7732	(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	159.3057	139.7127	145.0945	127.8067	123.6068	108.0971	101.5882	114.5532	115.3220	132.6485	143.1038	154.7132	(64)
Efficiency of water heater (217)m	89.1917	89.0307	88.5743	87.8233	87.3697	87.3000	87.3000	87.3000	87.3000	87.8812	88.8347	87.3000	(216)
												89.2671	(217)
Fuel for water heating, kWh/month	178.6104	156.9264	163.8110	145.5271	141.4755	123.8226	116.3667	131.2179	132.0985	150.9408	161.0899	173.3148	(219)

Water heating fuel used	1775.2016	(219)
Annual totals kWh/year		
Space heating fuel - main system	1061.6961	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	39.1242	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1242	(231)
Electricity for lighting (calculated in Appendix L)	343.0552	(232)
Total delivered energy for all uses	3294.0770	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1061.6961	3.6300	38.5396	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1775.2016	3.6300	64.4398	(247)
Mechanical ventilation fans	39.1242	19.4400	7.6057	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	343.0552	19.4400	66.6899	(250)
Additional standing charges			95.0000	(251)
Total energy cost			286.8550	(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	1061.6961	0.2160	229.3263	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1775.2016	0.2160	383.4435	(264)
Space and water heating			612.7699	(265)
Pumps and fans	114.1242	0.5190	59.2304	(267)
Energy for lighting	343.0552	0.5190	178.0456	(268)
Total kg/year			850.0460	(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	1061.6961	1.2200	1295.2692	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1775.2016	1.2200	2165.7459	(264)
Space and water heating			3461.0151	(265)
Pumps and fans	114.1242	3.0700	350.3612	(267)
Energy for lighting	343.0552	3.0700	1053.1794	(268)
Primary energy kWh/year			4864.5557	(272)
Primary energy kWh/m2/year			66.9864	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 90

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 86
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 488 TEST (12 Jan 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£89	£89	£0
Mains gas	£198	£198	£0
Space heating	£156	£156	£0
Water heating	£64	£64	£0
Lighting	£67	£67	£0
Total cost of fuels	£287	£287	£0
Total cost of uses	£287	£287	£0
Delivered energy	45 kWh/m²	45 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	67 kWh/m²	67 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	East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	345.09	(P1)
Transmission heat loss coefficient	32.74	(37)
Summer heat loss coefficient	377.83	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
West	1.000	0.90	1.000	0.900	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
West	10.2200	117.5071	0.4500	0.0000	0.9000	486.3735
total:						486.3735

	Jun	Jul	Aug	
Solar gains	516	486	428	(P4)
Internal gains	403	386	394	
Total summer gains	919	873	822	(P5)
Summer gain/loss ratio	2.43	2.31	2.18	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.68	20.46	20.23	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant