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

Property Reference	SECPMW025s_121_As_Built	**Issued on Date**	04/02/2022
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	86 B	**DER**	14.30	**TER**	15.69
Environmental	90 B	**% DER<TER**	8.89		
CO_2 Emissions (t/year)	0.84	**DFEE**	31.50	**TFEE**	34.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.78		

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

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

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 71 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.69 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.30 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)31.5 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.36 (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: 3.74 (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): Medium OK
Based on:
Overshading: Average
Windows facing East: 2.88 m², No overhang
Windows facing South: 9.04 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.7 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.7500 (1b)	x	2.4000 (2b)	=	169.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.8000	(5)

2. Ventilation rate

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =		0.0000	(8)
Pressure test			Yes	
Measured/design AP50			3.7400	
Infiltration rate			0.1870	(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) =		0.1449	(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	0.1848	0.1812	0.1775	0.1594	0.1558	0.1377	0.1377	0.1341	0.1449	0.1558	0.1630	0.1703	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.9200	1.2357	14.7300			(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260			(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099			(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196			(29a)
Total net area of external elements Aum(A, m2)			74.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0055			(33)
Party Wall 1			13.2000	0.0000	0.0000			(32)
Party Floor 1			70.7500					(32d)
Party Ceilings 1			70.7500					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.8036	(36)
Total fabric heat loss (33) + (36) =	39.8091	(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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	(38)
Heat transfer coeff	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	(39)
Average = Sum(39)m / 12 =												67.8261	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	(40)
HLP (average)												0.9587	(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	2.2642	(42)
Average daily hot water use (litres/day)	87.9746	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721	(44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820	(45)
Energy content (annual)										Total = Sum(45)m =		1384.1834	(45)

Distribution loss (46)m = 0.15 x (45)m

	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473	(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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793	(61)
Total heat required for water heating calculated for each month	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
								Total per year (kWh/year) = Sum(64)m =				1549.1071	(64)
Heat gains from water heating, kWh/month	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432	(72)
Total internal gains	346.2057	344.1818	331.7057	311.6588	291.4071	271.8389	259.1020	264.8088	275.0895	295.3373	318.5751	335.9057	(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	
East	2.8800	19.6403	0.4500	0.0000	0.7700	19.5994	(76)
South	9.0400	46.7521	0.4500	0.0000	0.7700	146.4443	(78)

Solar gains	166.0437	278.1786	368.6526	437.3820	472.6750	461.8052	448.3212	423.0463	392.5786	304.1822	198.0246	142.6590	(83)
Total gains	512.2494	622.3605	700.3583	749.0408	764.0822	733.6441	707.4232	687.8552	667.6681	599.5194	516.5997	478.5647	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	
alpha	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	
util living area	0.9946	0.9834	0.9559	0.8896	0.7610	0.5800	0.4203	0.4511	0.6720	0.9133	0.9862	0.9963	(86)
MIT	20.1429	20.3399	20.5681	20.7877	20.9322	20.9882	20.9984	20.9977	20.9734	20.7829	20.4040	20.0886	(87)
Th 2	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	(88)
util rest of house	0.9929	0.9785	0.9433	0.8602	0.7072	0.5051	0.3369	0.3659	0.5974	0.8832	0.9813	0.9951	(89)
MIT 2	19.3419	19.5359	19.7561	19.9576	20.0758	20.1129	20.1175	20.1173	20.1051	19.9583	19.6007	19.2880	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.6393	19.8344	20.0576	20.2658	20.3938	20.4379	20.4446	20.4442	20.4275	20.2645	19.8990	19.5853	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.4893	19.6844	19.9076	20.1158	20.2438	20.2879	20.2946	20.2942	20.2775	20.1145	19.7490	19.4353	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9755	0.9397	0.8601	0.7153	0.5199	0.3537	0.3831	0.6114	0.8831	0.9787	0.9939	(94)
Useful gains	507.8270	607.1353	658.1432	644.2448	546.5837	381.4179	250.2098	263.5114	408.2272	529.4122	505.5711	475.6583	(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	1030.2310	1002.7700	909.3880	760.7252	579.4937	385.7886	250.5918	264.1265	418.9953	645.3288	857.9339	1033.3485	(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	388.6686	265.8665	186.9261	83.8659	24.4850	0.0000	0.0000	0.0000	0.0000	86.2420	253.7012	414.9215	(98)
Space heating												1704.6768	(98)
Space heating per m2											(98) / (4) =	24.0944	(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	1883.6207	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	388.6686	265.8665	186.9261	83.8659	24.4850	0.0000	0.0000	0.0000	0.0000	86.2420	253.7012	414.9215	(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)	429.4681	293.7751	206.5482	92.6695	27.0553	0.0000	0.0000	0.0000	0.0000	95.2950	280.3328	458.4768	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5530	89.3793	89.0816	88.5484	87.8179	87.3000	87.3000	87.3000	87.3000	88.5414	89.3272	89.6148	(217)
Fuel for water heating, kWh/month	175.9853	154.6455	161.1507	142.8205	139.2881	122.5508	115.1882	129.8653	130.7295	148.2420	158.4992	170.7992	(219)
Water heating fuel used												1749.7642	(219)

Annual totals kWh/year

Space heating fuel - main system	1883.6207	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	38.1167	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.1167	(231)
Electricity for lighting (calculated in Appendix L)	323.7346	(232)
Total delivered energy for all uses	4070.2363	(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	1883.6207	0.2160	406.8621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1749.7642	0.2160	377.9491	(264)
Space and water heating			784.8111	(265)
Pumps and fans	113.1167	0.5190	58.7076	(267)
Energy for lighting	323.7346	0.5190	168.0183	(268)
Total CO2, kg/year			1011.5370	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3000	(273)

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

DER		14.3000	ZC1
Total Floor Area	TFA	70.7500	
Assumed number of occupants	N	2.2642	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6710	ZC2
CO2 emissions from cooking, equation (L16)		2.4500	ZC3
Total CO2 emissions		33.4211	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		33.4211	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.7500 (1b)	x	2.4000 (2b)	=	169.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.8000	(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) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(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) =	0.3307	(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	0.4216	0.4133	0.4051	0.3637	0.3555	0.3141	0.3141	0.3059	0.3307	0.3555	0.3720	0.3885	(22b)
Effective ac	0.5889	0.5854	0.5820	0.5662	0.5632	0.5493	0.5493	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			11.9200	1.3258	15.8030			(27)
WT-E-01	43.5500	11.9200	31.6300	0.1800	5.6934			(29a)
WT-I-01	22.5700	2.1200	20.4500	0.1800	3.6810			(29a)
WT-I-11	8.1100		8.1100	0.1800	1.4598			(29a)
Total net area of external elements Aum(A, m2)			74.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.7572			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7127	(36)
Total fabric heat loss						(33) + (36) =	35.4699	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.9972	32.8038	32.6143	31.7239	31.5573	30.7819	30.7819	30.6383	31.0806	31.5573	31.8943	32.2466	(38)
Heat transfer coeff	68.4671	68.2737	68.0842	67.1938	67.0273	66.2518	66.2518	66.1082	66.5505	67.0273	67.3642	67.7166	(39)
Average = Sum(39)m / 12 =												67.1930	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9677	0.9650	0.9623	0.9497	0.9474	0.9364	0.9364	0.9344	0.9406	0.9474	0.9521	0.9571	(40)
HLP (average)												0.9497	(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	2.2642	(42)
Average daily hot water use (litres/day)	87.9746	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721	(44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820	(45)
Energy content (annual)										Total = Sum(45)m =		1384.1834	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	49.3140	42.9220	45.7275	42.5171	42.1410	39.0463	40.3478	42.1410	42.5171	45.7275	45.9878	49.3140	(61)
Total heat required for water heating calculated for each month													
	192.8242	168.4369	175.2477	155.4359	150.4894	132.5426	126.9859	141.5595	143.1229	162.9740	173.9715	188.2960	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	192.8242	168.4369	175.2477	155.4359	150.4894	132.5426	126.9859	141.5595	143.1229	162.9740	173.9715	188.2960	(64)
Total per year (kWh/year) = Sum(64)m =												1911.8865	(64)
Heat gains from water heating, kWh/month													
	60.0456	52.4642	54.4973	48.1748	46.5611	40.8491	38.8941	43.5919	44.0807	50.4163	54.0515	58.5400	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)													
	80.7065	78.0717	73.2491	66.9094	62.5821	56.7349	52.2771	58.5913	61.2232	67.7639	75.0716	78.6828	(72)
Total internal gains													
	358.0418	355.4228	342.3549	321.7180	300.8727	280.7125	267.9819	274.2803	285.1576	305.9954	329.8211	347.7453	(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	
East	2.8800	19.6403	0.6300	0.7000	0.7700	17.2867	(76)
South	9.0400	46.7521	0.6300	0.7000	0.7700	129.1639	(78)

Solar gains	146.4506	245.3536	325.1516	385.7709	416.8994	407.3121	395.4193	373.1269	346.2543	268.2887	174.6577	125.8252	(83)
Total gains	504.4923	600.7764	667.5065	707.4890	717.7721	688.0246	663.4012	647.4072	631.4119	574.2840	504.4788	473.5705	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.7599	71.9632	72.1635	73.1197	73.3014	74.1594	74.1594	74.3205	73.8266	73.3014	72.9347	72.5553	
alpha	5.7840	5.7975	5.8109	5.8746	5.8868	5.9440	5.9440	5.9547	5.9218	5.8868	5.8623	5.8370	
util living area													
	0.9951	0.9861	0.9642	0.9068	0.7883	0.6025	0.4376	0.4669	0.6934	0.9236	0.9875	0.9965	(86)
MIT	20.1193	20.3038	20.5277	20.7638	20.9207	20.9869	20.9983	20.9975	20.9705	20.7703	20.3966	20.0841	(87)
Th 2	20.1103	20.1126	20.1149	20.1254	20.1274	20.1367	20.1367	20.1384	20.1331	20.1274	20.1234	20.1192	(88)
util rest of house													
	0.9935	0.9819	0.9535	0.8804	0.7363	0.5271	0.3527	0.3810	0.6193	0.8960	0.9830	0.9954	(89)
MIT 2	18.9414	19.2098	19.5301	19.8603	20.0540	20.1283	20.1360	20.1374	20.1119	19.8771	19.3542	18.8969	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.3788	19.6160	19.9005	20.1958	20.3758	20.4471	20.4562	20.4567	20.4307	20.2087	19.7412	19.3377	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3788	19.6160	19.9005	20.1958	20.3758	20.4471	20.4562	20.4567	20.4307	20.2087	19.7412	19.3377	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9918	0.9790	0.9504	0.8828	0.7520	0.5548	0.3843	0.4130	0.6457	0.8990	0.9805	0.9940	(94)
Useful gains	500.3603	588.1409	634.4216	624.5654	539.7471	381.7073	254.9382	267.3561	407.7162	516.2641	494.6561	470.7467	(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													
	1032.4004	1004.7178	912.3635	759.0063	581.5172	387.3813	255.4794	268.1840	421.3135	644.0455	851.5677	1025.0735	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	395.8378	279.9396	206.7888	96.7974	31.0770	0.0000	0.0000	0.0000	0.0000	95.0693	256.9764	412.4191	(98)
Space heating												1774.9055	(98)
Space heating per m2											(98) / (4) =	25.0870	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1900.3271	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	395.8378	279.9396	206.7888	96.7974	31.0770	0.0000	0.0000	0.0000	0.0000	95.0693	256.9764	412.4191	(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)	423.8092	299.7212	221.4013	103.6375	33.2730	0.0000	0.0000	0.0000	0.0000	101.7873	275.1353	441.5622	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	192.8242	168.4369	175.2477	155.4359	150.4894	132.5426	126.9859	141.5595	143.1229	162.9740	173.9715	188.2960	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8229	86.3213	85.4687	83.8972	81.8655	80.3000	80.3000	80.3000	80.3000	83.7472	86.0317	86.9711	(217)
Fuel for water heating, kWh/month	222.0892	195.1278	205.0431	185.2695	183.8251	165.0593	158.1394	176.2884	178.2353	194.6022	202.2180	216.5040	(219)
Water heating fuel used												2282.4012	(219)
Annual totals kWh/year													
Space heating fuel - main system												1900.3271	(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)												323.7346	(232)
Total delivered energy for all uses												4581.4630	(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	1900.3271	0.2160	410.4707	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2282.4012	0.2160	492.9987	(264)
Space and water heating			903.4693	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	323.7346	0.5190	168.0183	(268)
Total CO2, kg/m2/year			1110.4126	(272)
Emissions per m2 for space and water heating			12.7699	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3748	(272b)
Emissions per m2 for pumps and fans			0.5502	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.7699 * 1.00) + 2.3748 + 0.5502, rounded to 2 d.p.			15.6900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.7500 (1b)	x	2.4000 (2b)	=	169.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.8000	(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) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3637	(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) =	0.2819	(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	0.3594	0.3523	0.3453	0.3100	0.3030	0.2678	0.2678	0.2607	0.2819	0.3030	0.3171	0.3312	(22b)
Effective ac	0.5646	0.5621	0.5596	0.5481	0.5459	0.5358	0.5358	0.5340	0.5397	0.5459	0.5503	0.5548	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.9200	1.2357	14.7300			(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260			(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099			(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196			(29a)
Total net area of external elements Aum(A, m2)			74.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0055			(33)
Party Wall 1			13.2000	0.0000	0.0000			(32)
Party Floor 1			70.7500					(32d)
Party Ceilings 1			70.7500					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8036	(36)
Total fabric heat loss						(33) + (36) =	39.8091	(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	31.6351	31.4946	31.3569	30.7101	30.5890	30.0257	30.0257	29.9213	30.2427	30.5890	30.8339	31.0898	(38)
Heat transfer coeff	71.4442	71.3037	71.1660	70.5192	70.3982	69.8348	69.8348	69.7305	70.0518	70.3982	70.6430	70.8990	(39)
Average = Sum(39)m / 12 =												70.5186	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0098	1.0078	1.0059	0.9967	0.9950	0.9871	0.9871	0.9856	0.9901	0.9950	0.9985	1.0021	(40)
HLP (average)												0.9967	(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	2.2642	(42)
Average daily hot water use (litres/day)	87.9746	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721	(44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820	(45)
Energy content (annual)										Total = Sum(45)m =		1384.1834	(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													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.4959	26.6719	27.5230	23.9953	23.0240	19.8680	18.4106	21.1264	21.3787	24.9149	27.1965	29.5337	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)													
	40.9891	39.6904	36.9933	33.3267	30.9463	27.5944	24.7454	28.3957	29.6927	33.4877	37.7730	39.6958	(72)
Total internal gains													
	315.3244	314.0415	303.0991	285.1354	266.2368	248.5720	237.4503	241.0848	250.6270	268.7192	289.5225	305.7583	(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	
East	2.8800	19.6403	0.4500	0.0000	0.7700	19.5994	(76)
South	9.0400	46.7521	0.4500	0.0000	0.7700	146.4443	(78)

Solar gains	166.0437	278.1786	368.6526	437.3820	472.6750	461.8052	448.3212	423.0463	392.5786	304.1822	198.0246	142.6590	(83)
Total gains	481.3681	592.2201	671.7517	722.5174	738.9119	710.3772	685.7715	664.1311	643.2057	572.9014	487.5471	448.4173	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.7696	68.9051	69.0385	69.6717	69.7915	70.3545	70.3545	70.4598	70.1366	69.7915	69.5496	69.2985	
alpha	5.5846	5.5937	5.6026	5.6448	5.6528	5.6903	5.6903	5.6973	5.6758	5.6528	5.6366	5.6199	
util living area													
	0.9962	0.9879	0.9665	0.9104	0.7939	0.6117	0.4455	0.4790	0.7081	0.9324	0.9902	0.9974	(86)
MIT	20.0280	20.2329	20.4784	20.7330	20.9070	20.9830	20.9976	20.9964	20.9619	20.7296	20.3186	19.9853	(87)
Th 2	20.0752	20.0768	20.0784	20.0861	20.0875	20.0941	20.0941	20.0954	20.0916	20.0875	20.0846	20.0816	(88)
util rest of house													
	0.9950	0.9842	0.9563	0.8842	0.7408	0.5325	0.3552	0.3869	0.6312	0.9066	0.9865	0.9966	(89)
MIT 2	19.1924	19.3964	19.6368	19.8812	20.0286	20.0868	20.0935	20.0944	20.0728	19.8846	19.4890	19.1552	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.5026	19.7070	19.9493	20.1975	20.3548	20.4195	20.4292	20.4293	20.4029	20.1984	19.7970	19.4634	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5026	19.7070	19.9493	20.1975	20.3548	20.4195	20.4292	20.4293	20.4029	20.1984	19.7970	19.4634	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9823	0.9546	0.8877	0.7573	0.5616	0.3888	0.4212	0.6588	0.9102	0.9850	0.9958	(94)
Useful gains	478.5067	581.7445	641.2526	641.3931	559.5863	398.9808	266.6428	279.7553	423.7215	521.4522	480.2568	446.5536	(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													
	1086.1401	1055.7930	957.1340	796.6904	609.2802	406.4063	267.4120	280.9649	441.5314	675.7067	896.9557	1082.1581	(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													
	452.0792	318.5606	235.0158	111.8141	36.9722	0.0000	0.0000	0.0000	0.0000	114.7653	300.0231	472.8897	(98)
Space heating												2042.1201	(98)
Space heating per m2											(98) / (4) =	28.8639	(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	656.4472	516.7776	529.9517	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9520	0.9799	0.9747	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	624.9607	506.3849	516.5592	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	914.6713	884.2278	860.3773	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	208.5917	281.1151	255.8007	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												745.5075	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	52.1479	70.2788	63.9502	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												186.3769	(107)
Space cooling per m2												2.6343	(108)
Energy for space heating												28.8639	(99)
Energy for space cooling												2.6343	(108)
Total												31.4982	(109)
Dwelling Fabric Energy Efficiency (DFEE)												31.5	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.7500 (1b)	x	2.4000 (2b)	=	169.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.8000	(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) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(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) =	0.3307	(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	0.4216	0.4133	0.4051	0.3637	0.3555	0.3141	0.3141	0.3059	0.3307	0.3555	0.3720	0.3885	(22b)
Effective ac	0.5889	0.5854	0.5820	0.5662	0.5632	0.5493	0.5493	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			11.9200	1.3258	15.8030			(27)
WT-E-01	43.5500	11.9200	31.6300	0.1800	5.6934			(29a)
WT-I-01	22.5700	2.1200	20.4500	0.1800	3.6810			(29a)
WT-I-11	8.1100		8.1100	0.1800	1.4598			(29a)
Total net area of external elements Aum(A, m2)			74.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.7572			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7127	(36)
Total fabric heat loss						(33) + (36) =	35.4699	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.9972	32.8038	32.6143	31.7239	31.5573	30.7819	30.7819	30.6383	31.0806	31.5573	31.8943	32.2466	(38)
Heat transfer coeff	68.4671	68.2737	68.0842	67.1938	67.0273	66.2518	66.2518	66.1082	66.5505	67.0273	67.3642	67.7166	(39)
Average = Sum(39)m / 12 =												67.1930	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9677	0.9650	0.9623	0.9497	0.9474	0.9364	0.9364	0.9344	0.9406	0.9474	0.9521	0.9571	(40)
HLP (average)												0.9497	(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	2.2642	(42)
Average daily hot water use (litres/day)	87.9746	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721	(44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820	(45)
Energy content (annual)										Total = Sum(45)m =		1384.1834	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.4959	26.6719	27.5230	23.9953	23.0240	19.8680	18.4106	21.1264	21.3787	24.9149	27.1965	29.5337	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	113.2097	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.3312	16.2816	13.2411	10.0244	7.4933	6.3262	6.8357	8.8853	11.9258	15.1425	17.6735	18.8407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.0411	201.1066	195.9018	184.8214	170.8343	157.6885	148.9063	146.8409	152.0457	163.1261	177.1131	190.2589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	34.3210	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)													
	40.9891	39.6904	36.9933	33.3267	30.9463	27.5944	24.7454	28.3957	29.6927	33.4877	37.7730	39.6958	(72)
Total internal gains													
	315.3244	314.0415	303.0991	285.1354	266.2368	248.5720	237.4503	241.0848	250.6270	268.7192	289.5225	305.7583	(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	
East	2.8800	19.6403	0.6300	0.7000	0.7700	17.2867	(76)
South	9.0400	46.7521	0.6300	0.7000	0.7700	129.1639	(78)

Solar gains	146.4506	245.3536	325.1516	385.7709	416.8994	407.3121	395.4193	373.1269	346.2543	268.2887	174.6577	125.8252	(83)
Total gains	461.7749	559.3950	628.2507	670.9063	683.1362	655.8842	632.8696	614.2116	596.8814	537.0079	464.1802	431.5835	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	71.7599	71.9632	72.1635	73.1197	73.3014	74.1594	74.1594	74.3205	73.8266	73.3014	72.9347	72.5553	
alpha	5.7840	5.7975	5.8109	5.8746	5.8868	5.9440	5.9440	5.9547	5.9218	5.8868	5.8623	5.8370	
util living area													
	0.9968	0.9901	0.9724	0.9229	0.8129	0.6285	0.4581	0.4913	0.7245	0.9407	0.9917	0.9978	(86)
MIT	20.0621	20.2509	20.4828	20.7329	20.9062	20.9837	20.9978	20.9967	20.9630	20.7355	20.3445	20.0273	(87)
Th 2	20.1103	20.1126	20.1149	20.1254	20.1274	20.1367	20.1367	20.1384	20.1331	20.1274	20.1234	20.1192	(88)
util rest of house													
	0.9958	0.9870	0.9638	0.8996	0.7628	0.5513	0.3696	0.4013	0.6502	0.9177	0.9886	0.9971	(89)
MIT 2	19.2554	19.4443	19.6731	19.9177	20.0671	20.1295	20.1361	20.1375	20.1146	19.9265	19.5472	19.2282	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.5550	19.7438	19.9737	20.2204	20.3787	20.4467	20.4561	20.4565	20.4296	20.2269	19.8432	19.5249	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5550	19.7438	19.9737	20.2204	20.3787	20.4467	20.4561	20.4565	20.4296	20.2269	19.8432	19.5249	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9855	0.9622	0.9024	0.7782	0.5797	0.4026	0.4348	0.6768	0.9207	0.9873	0.9965	(94)
Useful gains	459.4710	551.2573	604.5037	605.4238	531.6181	380.2376	254.7763	267.0793	403.9518	494.4228	458.2941	430.0749	(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													
	1044.4628	1013.4412	917.3481	760.6617	581.7087	387.3517	255.4711	268.1693	421.2389	645.2619	858.4379	1037.7515	(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													
	435.2340	310.5876	232.7562	111.7713	37.2674	0.0000	0.0000	0.0000	0.0000	112.2243	288.1035	452.1113	(98)
Space heating												1980.0557	(98)
Space heating per m2											(98) / (4) =	27.9867	(99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Calculated for June, July and August. See Table 10b													
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	622.7669	490.2633	502.4222	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9527	0.9808	0.9760	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	593.2853	480.8558	490.3711	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	850.9782	822.3944	802.0299	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	185.5389	254.1047	231.8742	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												671.5178	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	46.3847	63.5262	57.9685	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												167.8794	(107)
Space cooling per m2												2.3729	(108)
Energy for space heating												27.9867	(99)
Energy for space cooling												2.3729	(108)
Total												30.3595	(109)
Target Fabric Energy Efficiency (TFEE)												34.9	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.7500 (1b)	x	2.4000 (2b)	=	169.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.8000	(5)

2. Ventilation rate

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =		0.0000	(8)
Pressure test			Yes	
Measured/design AP50			3.7400	
Infiltration rate			0.1870	(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) =		0.1449	(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	0.1522	0.1449	0.1449	0.1341	0.1341	0.1196	0.1232	0.1159	0.1196	0.1268	0.1268	0.1377	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.9200	1.2357	14.7300			(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260			(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099			(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196			(29a)
Total net area of external elements Aum(A, m2)			74.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0055			(33)
Party Wall 1			13.2000	0.0000	0.0000			(32)
Party Floor 1			70.7500					(32d)
Party Ceilings 1			70.7500					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8036	(36)
Total fabric heat loss					(33) + (36) =		39.8091	(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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	(38)
Heat transfer coeff	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	(39)
Average = Sum(39)m / 12 =												67.8261	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	(40)
HLP (average)												0.9587	(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	2.2642	(42)
Average daily hot water use (litres/day)	87.9746	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721	(44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820	(45)
Energy content (annual)										Total = Sum(45)m =		1384.1834	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473	(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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793	(61)
Total heat required for water heating calculated for each month	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
								Total per year (kWh/year) = Sum(64)m =				1549.1071	(64)
RHI water heating demand												1549	(64)
Heat gains from water heating, kWh/month	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8280	40.7040	33.1027	25.0609	18.7333	15.8155	17.0892	22.2131	29.8144	37.8562	44.1838	47.1017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.0763	300.1591	292.3907	275.8528	254.9766	235.3560	222.2482	219.1655	226.9338	243.4717	264.3479	283.9685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432	(72)
Total internal gains	510.9080	506.8271	487.2266	456.8971	425.9597	398.1660	381.8677	389.6316	407.0366	437.5670	471.4905	497.0467	(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	
East	2.8800	22.3313	0.4500	0.0000	0.7700	22.2849	(76)
South	9.0400	50.9848	0.4500	0.0000	0.7700	159.7028	(78)

Solar gains	181.9877	273.9406	358.5521	440.0766	466.0135	488.8042	468.7322	449.9359	414.2876	319.6994	222.2385	154.9329	(83)
Total gains	692.8957	780.7677	845.7787	896.9737	891.9732	886.9702	850.6000	839.5675	821.3242	757.2664	693.7290	651.9796	(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	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	
alpha	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	
util living area	0.9715	0.9464	0.8879	0.7697	0.5947	0.3815	0.2471	0.2584	0.4755	0.7713	0.9346	0.9783	(86)
MIT	20.4426	20.5796	20.7642	20.9141	20.9833	20.9989	20.9999	20.9999	20.9961	20.9264	20.6790	20.3940	(87)
Th 2	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	(88)
util rest of house	0.9635	0.9326	0.8618	0.7255	0.5342	0.3146	0.1768	0.1872	0.4049	0.7186	0.9154	0.9720	(89)
MIT 2	19.6352	19.7651	19.9341	20.0597	20.1093	20.1176	20.1179	20.1179	20.1165	20.0717	19.8609	19.5885	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.9350	20.0676	20.2423	20.3770	20.4338	20.4448	20.4454	20.4454	20.4431	20.3891	20.1646	19.8876	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7850	19.9176	20.0923	20.2270	20.2838	20.2948	20.2954	20.2954	20.2931	20.2391	20.0146	19.7376	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9599	0.9291	0.8610	0.7313	0.5458	0.3281	0.1910	0.2016	0.4190	0.7263	0.9128	0.9686	(94)
Useful gains	665.1383	725.3787	728.2229	655.9134	486.8680	291.0059	162.4631	169.2416	344.1571	549.9908	633.2163	631.5338	(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	996.0256	971.1046	860.8687	700.4382	494.0331	291.3030	162.4715	169.2535	345.4452	585.9565	814.9074	992.8115	(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	246.1802	165.1278	98.6884	32.0578	5.3308	0.0000	0.0000	0.0000	0.0000	26.7585	130.8176	268.7906	(98)
Space heating												973.7518	(98)
RHI space heating demand												974	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.7500 (1b)	x	2.4000 (2b)	=	169.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.8000	(5)

2. Ventilation rate

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =		0.0000	(8)
Pressure test			Yes	
Measured/design AP50			3.7400	
Infiltration rate			0.1870	(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) =		0.1449	(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	0.1848	0.1812	0.1775	0.1594	0.1558	0.1377	0.1377	0.1341	0.1449	0.1558	0.1630	0.1703	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.9200	1.2357	14.7300			(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260			(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099			(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196			(29a)
Total net area of external elements Aum(A, m2)			74.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0055			(33)
Party Wall 1			13.2000	0.0000	0.0000			(32)
Party Floor 1			70.7500					(32d)
Party Ceilings 1			70.7500					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8036	(36)
Total fabric heat loss					(33) + (36) =		39.8091	(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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	(38)
Heat transfer coeff	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	(39)
Average = Sum(39)m / 12 =												67.8261	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	(40)
HLP (average)												0.9587	(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	2.2642	(42)
Average daily hot water use (litres/day)	87.9746	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721	(44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820	(45)
Energy content (annual)										Total = Sum(45)m =		1384.1834	(45)

Distribution loss (46)m = 0.15 x (45)m

	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473	(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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793	(61)
Total heat required for water heating calculated for each month	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
								Total per year (kWh/year) = Sum(64)m =				1549.1071	(64)
Heat gains from water heating, kWh/month	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8280	40.7040	33.1027	25.0609	18.7333	15.8155	17.0892	22.2131	29.8144	37.8562	44.1838	47.1017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.0763	300.1591	292.3907	275.8528	254.9766	235.3560	222.2482	219.1655	226.9338	243.4717	264.3479	283.9685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432	(72)
Total internal gains	510.9080	506.8271	487.2266	456.8971	425.9597	398.1660	381.8677	389.6316	407.0366	437.5670	471.4905	497.0467	(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	
East	2.8800	19.6403	0.4500	0.0000	0.7700	19.5994	(76)
South	9.0400	46.7521	0.4500	0.0000	0.7700	146.4443	(78)

Solar gains	166.0437	278.1786	368.6526	437.3820	472.6750	461.8052	448.3212	423.0463	392.5786	304.1822	198.0246	142.6590	(83)
Total gains	676.9517	785.0057	855.8792	894.2791	898.6348	859.9712	830.1889	812.6780	799.6152	741.7492	669.5151	639.7056	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	
alpha	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	
util living area	0.9794	0.9541	0.9058	0.8145	0.6727	0.5001	0.3589	0.3830	0.5743	0.8313	0.9564	0.9845	(86)
MIT	20.3540	20.5283	20.7137	20.8731	20.9639	20.9945	20.9993	20.9990	20.9879	20.8779	20.5840	20.2990	(87)
Th 2	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	(88)
util rest of house	0.9737	0.9426	0.8840	0.7767	0.6181	0.4333	0.2873	0.3101	0.5055	0.7883	0.9433	0.9802	(89)
MIT 2	19.5489	19.7160	19.8882	20.0268	20.0966	20.1156	20.1178	20.1177	20.1124	20.0343	19.7721	19.4954	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.8478	20.0176	20.1947	20.3410	20.4186	20.4419	20.4451	20.4449	20.4375	20.3475	20.0736	19.7938	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6978	19.8676	20.0447	20.1910	20.2686	20.2919	20.2951	20.2949	20.2875	20.1975	19.9236	19.6438	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9704	0.9388	0.8820	0.7801	0.6278	0.4466	0.3017	0.3248	0.5190	0.7926	0.9398	0.9772	(94)
Useful gains	656.8921	736.9471	754.8900	697.6230	564.1243	384.0574	250.4609	263.9214	414.9630	587.8753	629.2367	625.1494	(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	1044.3743	1015.1936	918.6837	765.8281	581.1780	386.0625	250.6234	264.1764	419.6739	650.9626	869.7727	1047.4921	(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	288.2868	186.9817	121.8625	49.1076	12.6880	0.0000	0.0000	0.0000	0.0000	46.9369	173.1859	314.2230	(98)
Space heating												1193.2724	(98)
Space heating per m2											(98) / (4) =	16.8660	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1318.5331	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	288.2868	186.9817	121.8625	49.1076	12.6880	0.0000	0.0000	0.0000	0.0000	46.9369	173.1859	314.2230	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	318.5489	206.6096	134.6547	54.2626	14.0198	0.0000	0.0000	0.0000	0.0000	51.8640	191.3657	347.2077	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.3425	89.1117	88.7407	88.1720	87.5911	87.3000	87.3000	87.3000	87.3000	88.1207	89.0321	89.4263	(217)
Fuel for water heating, kWh/month	176.3999	155.1100	161.7699	143.4302	139.6488	122.5508	115.1882	129.8653	130.7295	148.9496	159.0246	171.1592	(219)
Water heating fuel used												1753.8259	(219)

Annual totals kWh/year

Space heating fuel - main system	1318.5331	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	38.1167	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.1167	(231)
Electricity for lighting (calculated in Appendix L)	323.7346	(232)
Total delivered energy for all uses	3509.2103	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1318.5331	3.4800	45.8850	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1753.8259	3.4800	61.0331	(247)
Mechanical ventilation fans	38.1167	13.1900	5.0276	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	323.7346	13.1900	42.7006	(250)
Additional standing charges			120.0000	(251)
Total energy cost			284.5388	(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] =	1.0325	(257)
SAP value		85.5973	
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	1318.5331	0.2160	284.8031	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1753.8259	0.2160	378.8264	(264)
Space and water heating			663.6295	(265)
Pumps and fans	113.1167	0.5190	58.7076	(267)
Energy for lighting	323.7346	0.5190	168.0183	(268)
Total kg/year			890.3554	(272)
CO2 emissions per m2			12.5800	(273)
EI value			89.6926	
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 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.7500 (1b)	x	2.4000 (2b)	=	169.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.7500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	169.8000	(5)

2. Ventilation rate

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =		0.0000	(8)
Pressure test			Yes	
Measured/design AP50			3.7400	
Infiltration rate			0.1870	(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) =		0.1449	(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	0.1522	0.1449	0.1449	0.1341	0.1341	0.1196	0.1232	0.1159	0.1196	0.1268	0.1268	0.1377	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			11.9200	1.2357	14.7300			(27)
WT-E-01	43.5500	11.9200	31.6300	0.2000	6.3260			(29a)
WT-I-01	22.5700	2.1200	20.4500	0.2890	5.9099			(29a)
WT-I-11	8.1100		8.1100	0.3600	2.9196			(29a)
Total net area of external elements Aum(A, m2)			74.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0055			(33)
Party Wall 1			13.2000	0.0000	0.0000			(32)
Party Floor 1			70.7500					(32d)
Party Ceilings 1			70.7500					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8036	(36)
Total fabric heat loss					(33) + (36) =		39.8091	(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	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	28.0170	(38)
Heat transfer coeff	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	67.8261	(39)
Average = Sum(39)m / 12 =												67.8261	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	0.9587	(40)
HLP (average)												0.9587	(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	2.2642	(42)
Average daily hot water use (litres/day)	87.9746	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.7721	93.2531	89.7341	86.2151	82.6961	79.1772	79.1772	82.6961	86.2151	89.7341	93.2531	96.7721	(44)
Energy conte	143.5102	125.5149	129.5202	112.9188	108.3483	93.4963	86.6381	99.4185	100.6059	117.2464	127.9837	138.9820	(45)
Energy content (annual)										Total = Sum(45)m =		1384.1834	(45)

Distribution loss (46)m = 0.15 x (45)m

	21.5265	18.8272	19.4280	16.9378	16.2522	14.0245	12.9957	14.9128	15.0909	17.5870	19.1975	20.8473	(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	14.0899	12.7062	14.0355	13.5464	13.9716	13.4905	13.9212	13.9539	13.5210	14.0091	13.5992	14.0793	(61)
Total heat required for water heating calculated for each month													
	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
								Total per year (kWh/year) = Sum(64)m =				1549.1071	(64)
Heat gains from water heating, kWh/month													
	51.2396	44.9103	46.5743	40.9321	39.5187	34.4602	32.2875	36.5451	36.8317	42.4867	45.9544	49.7313	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	135.8517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.8280	40.7040	33.1027	25.0609	18.7333	15.8155	17.0892	22.2131	29.8144	37.8562	44.1838	47.1017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	297.0763	300.1591	292.3907	275.8528	254.9766	235.3560	222.2482	219.1655	226.9338	243.4717	264.3479	283.9685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	50.8494	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	-90.5678	(71)
Water heating gains (Table 5)													
	68.8704	66.8308	62.5999	56.8502	53.1165	47.8613	43.3971	49.1198	51.1551	57.1058	63.8255	66.8432	(72)
Total internal gains													
	510.9080	506.8271	487.2266	456.8971	425.9597	398.1660	381.8677	389.6316	407.0366	437.5670	471.4905	497.0467	(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	
East	2.8800	22.3313	0.4500	0.0000	0.7700	22.2849	(76)
South	9.0400	50.9848	0.4500	0.0000	0.7700	159.7028	(78)

Solar gains	181.9877	273.9406	358.5521	440.0766	466.0135	488.8042	468.7322	449.9359	414.2876	319.6994	222.2385	154.9329	(83)
Total gains	692.8957	780.7677	845.7787	896.9737	891.9732	886.9702	850.6000	839.5675	821.3242	757.2664	693.7290	651.9796	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	72.4381	
alpha	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	5.8292	
util living area													
	0.9715	0.9464	0.8879	0.7697	0.5947	0.3815	0.2471	0.2584	0.4755	0.7713	0.9346	0.9783	(86)
MIT	20.4426	20.5796	20.7642	20.9141	20.9833	20.9989	20.9999	20.9999	20.9961	20.9264	20.6790	20.3940	(87)
Th 2	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	20.1179	(88)
util rest of house													
	0.9635	0.9326	0.8618	0.7255	0.5342	0.3146	0.1768	0.1872	0.4049	0.7186	0.9154	0.9720	(89)
MIT 2	19.6352	19.7651	19.9341	20.0597	20.1093	20.1176	20.1179	20.1179	20.1165	20.0717	19.8609	19.5885	(90)
Living area fraction									fLA = Living area / (4) =			0.3713	(91)
MIT	19.9350	20.0676	20.2423	20.3770	20.4338	20.4448	20.4454	20.4454	20.4431	20.3891	20.1646	19.8876	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7850	19.9176	20.0923	20.2270	20.2838	20.2948	20.2954	20.2954	20.2931	20.2391	20.0146	19.7376	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9599	0.9291	0.8610	0.7313	0.5458	0.3281	0.1910	0.2016	0.4190	0.7263	0.9128	0.9686	(94)
Useful gains	665.1383	725.3787	728.2229	655.9134	486.8680	291.0059	162.4631	169.2416	344.1571	549.9908	633.2163	631.5338	(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													
	996.0256	971.1046	860.8687	700.4382	494.0331	291.3030	162.4715	169.2535	345.4452	585.9565	814.9074	992.8115	(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													
	246.1802	165.1278	98.6884	32.0578	5.3308	0.0000	0.0000	0.0000	0.0000	26.7585	130.8176	268.7906	(98)
Space heating												973.7518	(98)
Space heating per m2											(98) / (4) =	13.7633	(99)

8c. Space cooling requirement

Not applicable

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

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1075.9688	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	246.1802	165.1278	98.6884	32.0578	5.3308	0.0000	0.0000	0.0000	0.0000	26.7585	130.8176	268.7906	(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)	272.0223	182.4617	109.0480	35.4230	5.8904	0.0000	0.0000	0.0000	0.0000	29.5674	144.5498	297.0062	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	157.6001	138.2211	143.5557	126.4653	122.3199	106.9868	100.5593	113.3724	114.1268	131.2555	141.5829	153.0613	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.2235	89.0133	88.5759	87.9287	87.4291	87.3000	87.3000	87.3000	87.3000	87.8259	88.8080	89.3122	(217)
Fuel for water heating, kWh/month	176.6352	155.2814	162.0707	143.8270	139.9075	122.5508	115.1882	129.8653	130.7295	149.4497	159.4258	171.3779	(219)

Water heating fuel used	1756.3090	(219)
Annual totals kWh/year		
Space heating fuel - main system	1075.9688	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	38.1167	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	113.1167	(231)
Electricity for lighting (calculated in Appendix L)	323.7346	(232)
Total delivered energy for all uses	3269.1291	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1075.9688	3.6300	39.0577	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1756.3090	3.6300	63.7540	(247)
Mechanical ventilation fans	38.1167	19.4400	7.4099	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	323.7346	19.4400	62.9340	(250)
Additional standing charges			95.0000	(251)
Total energy cost			282.7356	(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	1075.9688	0.2160	232.4093	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1756.3090	0.2160	379.3627	(264)
Space and water heating			611.7720	(265)
Pumps and fans	113.1167	0.5190	58.7076	(267)
Energy for lighting	323.7346	0.5190	168.0183	(268)
Total kg/year			838.4978	(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	1075.9688	1.2200	1312.6820	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1756.3090	1.2200	2142.6969	(264)
Space and water heating			3455.3789	(265)
Pumps and fans	113.1167	3.0700	347.2683	(267)
Energy for lighting	323.7346	3.0700	993.8653	(268)
Primary energy kWh/year			4796.5125	(272)
Primary energy kWh/m2/year			67.7952	(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)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(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	£85	£85	£0
Mains gas	£198	£198	£0
Space heating	£156	£156	£0
Water heating	£64	£64	£0
Lighting	£63	£63	£0
Total cost of fuels	£283	£283	£0
Total cost of uses	£283	£283	£0
Delivered energy	46 kWh/m²	46 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	68 kWh/m²	68 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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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	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	168.10	(P1)
Transmission heat loss coefficient	39.81	(37)
Summer heat loss coefficient	207.91	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	1.000	0.90	1.000	0.900	(P8)
South	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
East	2.8800	117.5071	0.4500	0.0000	0.9000	137.0602
South	9.0400	112.2060	0.4500	0.0000	0.9000	410.8086
total:						547.8688

	Jun	Jul	Aug	
Solar gains	571	548	526	(P4)
Internal gains	395	379	387	
Total summer gains	966	927	913	(P5)
Summer gain/loss ratio	4.65	4.46	4.39	(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	20.90	22.61	22.44	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	

Assessment of likelihood of high internal temperature: Medium