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

Property Reference	SECPMW026q_109_As_Built	**Issued on Date**	10/06/2021
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	86 B	**DER**	13.18	**TER**	15.06
Environmental	90 B	**% DER<TER**	12.51		
CO_2 Emissions (t/year)	0.80	**DFEE**	26.06	**TFEE**	31.40
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.01		

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

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

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 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) 15.06 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.18 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)31.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)26.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.27 (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: 3.18 (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 South: 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
Air permeability 3.2 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	72.6800 (1b)	x	2.4000 (2b)	=	174.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		174.4320	(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		3.1800	
Infiltration rate		0.1590	(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) =	0.1232	(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	0.1571	0.1540	0.1510	0.1355	0.1325	0.1171	0.1171	0.1140	0.1232	0.1325	0.1386	0.1448	(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)			10.2200	1.2357	12.6293			(27)
WT-E-03	26.3800	10.2200	16.1600	0.1600	2.5856			(29a)
WT-I-02	22.2200	2.1200	20.1000	0.1584	3.1842			(29a)
WT-I-11	21.4800		21.4800	0.2719	5.8405			(29a)
Total net area of external elements Aum(A, m2)			70.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3596			(33)
Party Wall 1			16.4400	0.0000	0.0000			(32)
Party Floor 1			72.6800					(32d)
Party Ceilings 1			72.6800					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1748	(36)
Total fabric heat loss					(33) + (36) =		33.5344	(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	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	(38)
Heat transfer coeff	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	(39)
Average = Sum(39)m / 12 =												62.3157	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	(40)
HLP (average)												0.8574	(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	2.3094	(42)
Average daily hot water use (litres/day)	89.0480	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9529	94.3909	90.8290	87.2671	83.7052	80.1432	80.1432	83.7052	87.2671	90.8290	94.3909	97.9529	(44)
Energy conte	145.2613	127.0464	131.1005	114.2966	109.6703	94.6371	87.6952	100.6316	101.8334	118.6770	129.5453	140.6778	(45)
Energy content (annual)										Total = Sum(45)m =		1401.0725	(45)

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

	21.7892	19.0570	19.6651	17.1445	16.4505	14.1956	13.1543	15.0947	15.2750	17.8016	19.4318	21.1017	(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	14.0981	12.7131	14.0423	13.5522	13.9769	13.4948	13.9252	13.9587	13.5261	14.0153	13.6063	14.0873	(61)
Total heat required for water heating calculated for each month	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(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	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(64)
								Total per year (kWh/year) = Sum(64)m =				1566.0688	(64)
Heat gains from water heating, kWh/month	51.8239	45.4212	47.1015	41.3917	39.9596	34.8406	32.6400	36.9497	37.2411	42.9639	46.4754	50.2972	(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	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.4417	17.2680	14.0432	10.6316	7.9473	6.7094	7.2498	9.4235	12.6482	16.0598	18.7442	19.9821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.4695	205.5808	200.2602	188.9333	174.6351	161.1968	152.2192	150.1078	155.4284	166.7553	181.0535	194.4918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	(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)	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	(71)
Water heating gains (Table 5)	69.6558	67.5911	63.3085	57.4884	53.7091	48.3897	43.8709	49.6635	51.7238	57.7472	64.5491	67.6037	(72)
Total internal gains	353.2078	351.0807	338.2528	317.6942	296.9324	276.9368	263.9808	269.8357	280.4413	301.2033	324.9877	342.7185	(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	
South	10.2200	46.7521	0.4500	0.0000	0.7700	165.5598	(78)

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	518.7676	622.2251	683.6426	708.0597	703.7173	668.4119	646.4758	641.2914	641.2417	593.6578	521.2326	485.7774	(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	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	
alpha	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	
util living area	0.9941	0.9816	0.9532	0.8905	0.7685	0.5876	0.4231	0.4456	0.6525	0.8997	0.9842	0.9961	(86)
MIT	20.2835	20.4643	20.6562	20.8314	20.9471	20.9918	20.9991	20.9987	20.9842	20.8444	20.5179	20.2315	(87)
Th 2	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	(88)
util rest of house	0.9924	0.9764	0.9405	0.8626	0.7185	0.5185	0.3471	0.3692	0.5845	0.8683	0.9788	0.9948	(89)
MIT 2	19.5538	19.7314	19.9159	20.0761	20.1707	20.2003	20.2036	20.2035	20.1962	20.0906	19.7856	19.5023	(90)
Living area fraction									fLA = Living area / (4) =			0.3756	(91)
MIT	19.8279	20.0067	20.1939	20.3598	20.4624	20.4976	20.5024	20.5022	20.4922	20.3737	20.0607	19.7762	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.6779	19.8567	20.0439	20.2098	20.3124	20.3476	20.3524	20.3522	20.3422	20.2237	19.9107	19.6262	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9736	0.9375	0.8628	0.7257	0.5312	0.3614	0.3835	0.5966	0.8692	0.9763	0.9937	(94)
Useful gains	514.0310	605.8199	640.9391	610.9424	510.6933	355.0659	233.6124	245.9528	382.5847	516.0098	508.8852	482.7114	(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	958.2838	932.0360	843.9989	704.7771	536.6848	358.1633	233.8351	246.2851	388.9875	599.7102	798.3076	961.2922	(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	330.5241	219.2172	151.0765	67.5610	19.3377	0.0000	0.0000	0.0000	0.0000	62.2731	208.3841	356.0641	(98)
Space heating												1414.4377	(98)
Space heating per m2											(98) / (4) =	19.4612	(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	1562.9146	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	330.5241	219.2172	151.0765	67.5610	19.3377	0.0000	0.0000	0.0000	0.0000	62.2731	208.3841	356.0641	(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)													
	365.2200	242.2290	166.9353	74.6530	21.3676	0.0000	0.0000	0.0000	0.0000	68.8100	230.2587	393.4410	(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													
	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.4336	89.2267	88.9033	88.3805	87.7195	87.3000	87.3000	87.3000	87.3000	88.2972	89.1690	89.5060	(217)
Fuel for water heating, kWh/month													
	178.1873	156.6343	163.2593	144.6573	140.9575	123.8625	116.4037	131.2603	132.1415	150.2791	160.5396	172.9102	(219)
Water heating fuel used												1771.0927	(219)
Annual totals kWh/year													
Space heating fuel - main system												1562.9146	(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)	39.1565	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1565	(231)
Electricity for lighting (calculated in Appendix L)	343.3468	(232)
Total delivered energy for all uses	3791.5105	(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	1562.9146	0.2160	337.5895	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1771.0927	0.2160	382.5560	(264)
Space and water heating			720.1456	(265)
Pumps and fans	114.1565	0.5190	59.2472	(267)
Energy for lighting	343.3468	0.5190	178.1970	(268)
Total CO2, kg/year			957.5898	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1800	(273)

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

DER		13.1800	ZC1
Total Floor Area	TFA	72.6800	
Assumed number of occupants	N	2.3094	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5894	ZC2
CO2 emissions from cooking, equation (L16)		2.3999	ZC3
Total CO2 emissions		32.1693	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		32.1693	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	72.6800 (1b)	x	2.4000 (2b)	=	174.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.4320	(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) =	0.1720	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4220	(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) =	0.3270	(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	0.4170	0.4088	0.4006	0.3597	0.3516	0.3107	0.3107	0.3025	0.3270	0.3516	0.3679	0.3843	(22b)
Effective ac	0.5869	0.5836	0.5802	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5738	(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-03	26.3800	10.2200	16.1600	0.1800	2.9088			(29a)
WT-I-02	22.2200	2.1200	20.1000	0.1800	3.6180			(29a)
WT-I-11	21.4800		21.4800	0.1800	3.8664			(29a)
Total net area of external elements Aum(A, m2)			70.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.0624			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7535	(36)
Total fabric heat loss						(33) + (36) =	31.8159	(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	33.7854	33.5911	33.4007	32.5060	32.3386	31.5594	31.5594	31.4152	31.8596	32.3386	32.6773	33.0313	(38)
Heat transfer coeff	65.6014	65.4071	65.2166	64.3220	64.1546	63.3754	63.3754	63.2311	63.6755	64.1546	64.4932	64.8472	(39)
Average = Sum(39)m / 12 =												64.3212	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9026	0.8999	0.8973	0.8850	0.8827	0.8720	0.8720	0.8700	0.8761	0.8827	0.8874	0.8922	(40)
HLP (average)												0.8850	(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	2.3094	(42)
Average daily hot water use (litres/day)	89.0480	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9529	94.3909	90.8290	87.2671	83.7052	80.1432	80.1432	83.7052	87.2671	90.8290	94.3909	97.9529	(44)
Energy conte	145.2613	127.0464	131.1005	114.2966	109.6703	94.6371	87.6952	100.6316	101.8334	118.6770	129.5453	140.6778	(45)
Energy content (annual)										Total = Sum(45)m =		1401.0725	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7892	19.0570	19.6651	17.1445	16.4505	14.1956	13.1543	15.0947	15.2750	17.8016	19.4318	21.1017	(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	49.9157	43.4457	46.2855	43.0358	42.6552	39.5227	40.8401	42.6552	43.0358	46.2855	46.5490	49.9157	(61)
Total heat required for water heating calculated for each month	195.1770	170.4921	177.3860	157.3324	152.3256	134.1598	128.5353	143.2868	144.8692	164.9625	176.0942	190.5935	(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	195.1770	170.4921	177.3860	157.3324	152.3256	134.1598	128.5353	143.2868	144.8692	164.9625	176.0942	190.5935	(64)
Total per year (kWh/year) = Sum(64)m =												1935.2144	(64)
Heat gains from water heating, kWh/month	60.7783	53.1044	55.1623	48.7626	47.1292	41.3475	39.3687	44.1238	44.6186	51.0315	54.7110	59.2543	(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	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.4417	17.2680	14.0432	10.6316	7.9473	6.7094	7.2498	9.4235	12.6482	16.0598	18.7442	19.9821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.4695	205.5808	200.2602	188.9333	174.6351	161.1968	152.2192	150.1078	155.4284	166.7553	181.0535	194.4918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	(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)	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	(71)
Water heating gains (Table 5)	81.6913	79.0243	74.1429	67.7258	63.3457	57.4271	52.9149	59.3062	61.9702	68.5907	75.9876	79.6429	(72)
Total internal gains	365.2433	362.5140	349.0872	327.9316	306.5689	285.9742	273.0247	279.4784	290.6877	312.0467	336.4262	354.7576	(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	
South	10.2200	46.7521	0.6300	0.7000	0.7700	146.0238	(78)

Solar gains	146.0238	239.1493	304.6338	344.3023	358.7843	345.2811	337.3606	327.6239	318.2259	257.9449	173.0879	126.1780	(83)
Total gains	511.2670	601.6633	653.7210	672.2339	665.3532	631.2553	610.3853	607.1023	608.9137	569.9917	509.5141	480.9356	(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	76.9377	77.1663	77.3917	78.4681	78.6728	79.6401	79.6401	79.8218	79.2647	78.6728	78.2598	77.8325	
alpha	6.1292	6.1444	6.1594	6.2312	6.2449	6.3093	6.3093	6.3215	6.2843	6.2449	6.2173	6.1888	
util living area	0.9950	0.9860	0.9658	0.9163	0.8109	0.6279	0.4551	0.4767	0.6931	0.9199	0.9869	0.9964	(86)
MIT	20.2059	20.3775	20.5743	20.7796	20.9224	20.9874	20.9985	20.9980	20.9764	20.8059	20.4658	20.1727	(87)
Th 2	20.1653	20.1676	20.1698	20.1803	20.1822	20.1914	20.1914	20.1931	20.1879	20.1822	20.1783	20.1741	(88)
util rest of house	0.9934	0.9818	0.9557	0.8923	0.7625	0.5548	0.3724	0.3944	0.6226	0.8923	0.9823	0.9953	(89)
MIT 2	19.1092	19.3588	19.6407	19.9303	20.1090	20.1832	20.1908	20.1923	20.1708	19.9711	19.4965	19.0676	(90)
Living area fraction									fLA = Living area / (4) =			0.3756	(91)
MIT	19.5211	19.7414	19.9913	20.2493	20.4145	20.4852	20.4942	20.4949	20.4734	20.2847	19.8606	19.4827	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5211	19.7414	19.9913	20.2493	20.4145	20.4852	20.4942	20.4949	20.4734	20.2847	19.8606	19.4827	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9792	0.9532	0.8946	0.7771	0.5819	0.4035	0.4254	0.6482	0.8962	0.9800	0.9941	(94)
Useful gains	507.1088	589.1504	623.1169	601.3649	517.0426	367.3413	246.3110	258.2455	394.6786	510.8329	499.3473	478.0994	(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	998.5277	970.7342	879.8599	730.0089	559.0763	372.9794	246.7970	258.9264	405.8294	621.3162	822.9738	991.0408	(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	365.6156	256.4244	191.0168	92.6237	31.2731	0.0000	0.0000	0.0000	0.0000	82.1995	233.0110	381.6284	(98)
Space heating												1633.7925	(98)
Space heating per m2											(98) / (4) =	22.4793	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1749.2425	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	365.6156	256.4244	191.0168	92.6237	31.2731	0.0000	0.0000	0.0000	0.0000	82.1995	233.0110	381.6284	(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)	391.4514	274.5443	204.5147	99.1688	33.4829	0.0000	0.0000	0.0000	0.0000	88.0081	249.4765	408.5957	(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	195.1770	170.4921	177.3860	157.3324	152.3256	134.1598	128.5353	143.2868	144.8692	164.9625	176.0942	190.5935	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6087	86.0763	85.2378	83.7681	81.8578	80.3000	80.3000	80.3000	80.3000	83.3989	85.7571	86.7651	(217)
Fuel for water heating, kWh/month	225.3550	198.0708	208.1072	187.8191	186.0856	167.0733	160.0689	178.4393	180.4100	197.7995	205.3406	219.6661	(219)

Water heating fuel used	2314.2354	(219)
Annual totals kWh/year		
Space heating fuel - main system	1749.2425	(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)	343.3468	(232)
Total delivered energy for all uses	4481.8247	(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	1749.2425	0.2160	377.8364	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2314.2354	0.2160	499.8748	(264)
Space and water heating			877.7112	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.3468	0.5190	178.1970	(268)
Total CO2, kg/m2/year			1094.8332	(272)
Emissions per m2 for space and water heating			12.0764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4518	(272b)
Emissions per m2 for pumps and fans			0.5356	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.0764 * 1.00) + 2.4518 + 0.5356, rounded to 2 d.p.			15.0600	(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	72.6800 (1b)	x	2.4000 (2b)	=	174.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.4320	(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) =	0.1720	(8)
Pressure test		Yes	
Measured/design AP50		3.1800	
Infiltration rate		0.3310	(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) =	0.2565	(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	0.3271	0.3206	0.3142	0.2822	0.2758	0.2437	0.2437	0.2373	0.2565	0.2758	0.2886	0.3014	(22b)
Effective ac	0.5535	0.5514	0.5494	0.5398	0.5380	0.5297	0.5297	0.5281	0.5329	0.5380	0.5416	0.5454	(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-03	26.3800	10.2200	16.1600	0.1600	2.5856			(29a)
WT-I-02	22.2200	2.1200	20.1000	0.1584	3.1842			(29a)
WT-I-11	21.4800		21.4800	0.2719	5.8405			(29a)
Total net area of external elements Aum(A, m2)			70.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3596			(33)
Party Wall 1			16.4400	0.0000	0.0000			(32)
Party Floor 1			72.6800					(32d)
Party Ceilings 1			72.6800					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.1748	(36)
Total fabric heat loss (33) + (36) =	33.5344	(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	31.8599	31.7403	31.6232	31.0728	30.9698	30.4904	30.4904	30.4017	30.6751	30.9698	31.1781	31.3959	(38)
Heat transfer coeff	65.3943	65.2747	65.1576	64.6072	64.5042	64.0248	64.0248	63.9361	64.2095	64.5042	64.7125	64.9303	(39)
Average = Sum(39)m / 12 =												64.6067	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8998	0.8981	0.8965	0.8889	0.8875	0.8809	0.8809	0.8797	0.8835	0.8875	0.8904	0.8934	(40)
HLP (average)												0.8889	(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	2.3094	(42)
Average daily hot water use (litres/day)	89.0480	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9529	94.3909	90.8290	87.2671	83.7052	80.1432	80.1432	83.7052	87.2671	90.8290	94.3909	97.9529	(44)
Energy conte	145.2613	127.0464	131.1005	114.2966	109.6703	94.6371	87.6952	100.6316	101.8334	118.6770	129.5453	140.6778	(45)
Energy content (annual)										Total = Sum(45)m =		1401.0725	(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													
	30.8680	26.9974	27.8589	24.2880	23.3049	20.1104	18.6352	21.3842	21.6396	25.2189	27.5284	29.8940	(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	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4417	17.2680	14.0432	10.6316	7.9473	6.7094	7.2498	9.4235	12.6482	16.0598	18.7442	19.9821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.4695	205.5808	200.2602	188.9333	174.6351	161.1968	152.2192	150.1078	155.4284	166.7553	181.0535	194.4918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	(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)													
	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	(71)
Water heating gains (Table 5)													
	41.4893	40.1746	37.4447	33.7334	31.3238	27.9311	25.0474	28.7422	30.0550	33.8963	38.2338	40.1801	(72)
Total internal gains													
	322.0413	320.6643	309.3891	290.9392	271.5471	253.4782	242.1572	245.9144	255.7725	274.3524	295.6725	312.2949	(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	
South	10.2200	46.7521	0.4500	0.0000	0.7700	165.5598	(78)

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	487.6011	591.8086	654.7788	681.3046	678.3320	644.9533	624.6522	617.3701	616.5729	566.8070	491.9173	455.3538	(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	77.1814	77.3227	77.4618	78.1217	78.2464	78.8323	78.8323	78.9417	78.6056	78.2464	77.9945	77.7329	
alpha	6.1454	6.1548	6.1641	6.2081	6.2164	6.2555	6.2555	6.2628	6.2404	6.2164	6.1996	6.1822	
util living area													
	0.9961	0.9870	0.9655	0.9130	0.8033	0.6212	0.4493	0.4740	0.6903	0.9227	0.9891	0.9974	(86)
MIT	20.1790	20.3678	20.5765	20.7833	20.9254	20.9876	20.9986	20.9980	20.9763	20.7993	20.4399	20.1370	(87)
Th 2	20.1677	20.1691	20.1705	20.1769	20.1781	20.1838	20.1838	20.1848	20.1816	20.1781	20.1757	20.1731	(88)
util rest of house													
	0.9949	0.9832	0.9553	0.8884	0.7543	0.5481	0.3669	0.3913	0.6194	0.8957	0.9852	0.9965	(89)
MIT 2	19.4196	19.6073	19.8112	20.0097	20.1303	20.1783	20.1834	20.1842	20.1699	20.0286	19.6853	19.3824	(90)
Living area fraction										fLA = Living area / (4) =		0.3756	(91)
MIT	19.7048	19.8930	20.0987	20.3003	20.4290	20.4823	20.4896	20.4899	20.4728	20.3181	19.9688	19.6658	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7048	19.8930	20.0987	20.3003	20.4290	20.4823	20.4896	20.4899	20.4728	20.3181	19.9688	19.6658	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9816	0.9543	0.8925	0.7701	0.5754	0.3979	0.4224	0.6454	0.9008	0.9840	0.9959	(94)
Useful gains	484.6735	580.9292	624.8680	608.0480	522.3916	371.0867	248.5533	260.7955	397.9619	510.5931	484.0393	453.4743	(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													
	1007.3890	978.6614	886.0554	736.5384	563.0564	376.6128	249.0293	261.4913	409.1948	626.8597	832.7709	1004.1991	(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													
	388.9003	267.2761	194.3234	92.5131	30.2546	0.0000	0.0000	0.0000	0.0000	86.5023	251.0867	409.7393	(98)
Space heating												1720.5959	(98)
Space heating per m2											(98) / (4) =	23.6736	(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	601.8334	473.7837	485.9140	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9614	0.9856	0.9831	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	578.5930	466.9772	477.6864	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	840.2188	814.7903	807.8650	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	188.3706	258.7729	245.6529	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												692.7964	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	47.0926	64.6932	61.4132	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												173.1991	(107)
Space cooling per m2												2.3830	(108)
Energy for space heating												23.6736	(99)
Energy for space cooling												2.3830	(108)
Total												26.0566	(109)
Dwelling Fabric Energy Efficiency (DFEE)												26.1	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.6800 (1b)	x	2.4000 (2b)	=	174.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.4320	(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) =	0.1720	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4220	(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) =	0.3270	(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	0.4170	0.4088	0.4006	0.3597	0.3516	0.3107	0.3107	0.3025	0.3270	0.3516	0.3679	0.3843	(22b)
Effective ac	0.5869	0.5836	0.5802	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5738	(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-03	26.3800	10.2200	16.1600	0.1800	2.9088			(29a)
WT-I-02	22.2200	2.1200	20.1000	0.1800	3.6180			(29a)
WT-I-11	21.4800		21.4800	0.1800	3.8664			(29a)
Total net area of external elements Aum(A, m2)			70.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.0624			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7535	(36)
Total fabric heat loss						(33) + (36) =	31.8159	(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	33.7854	33.5911	33.4007	32.5060	32.3386	31.5594	31.5594	31.4152	31.8596	32.3386	32.6773	33.0313	(38)
Heat transfer coeff	65.6014	65.4071	65.2166	64.3220	64.1546	63.3754	63.3754	63.2311	63.6755	64.1546	64.4932	64.8472	(39)
Average = Sum(39)m / 12 =												64.3212	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9026	0.8999	0.8973	0.8850	0.8827	0.8720	0.8720	0.8700	0.8761	0.8827	0.8874	0.8922	(40)
HLP (average)												0.8850	(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	2.3094	(42)
Average daily hot water use (litres/day)	89.0480	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9529	94.3909	90.8290	87.2671	83.7052	80.1432	80.1432	83.7052	87.2671	90.8290	94.3909	97.9529	(44)
Energy conte	145.2613	127.0464	131.1005	114.2966	109.6703	94.6371	87.6952	100.6316	101.8334	118.6770	129.5453	140.6778	(45)
Energy content (annual)										Total = Sum(45)m =		1401.0725	(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	30.8680	26.9974	27.8589	24.2880	23.3049	20.1104	18.6352	21.3842	21.6396	25.2189	27.5284	29.8940	(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	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	115.4696	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4417	17.2680	14.0432	10.6316	7.9473	6.7094	7.2498	9.4235	12.6482	16.0598	18.7442	19.9821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.4695	205.5808	200.2602	188.9333	174.6351	161.1968	152.2192	150.1078	155.4284	166.7553	181.0535	194.4918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	34.5470	(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)													
	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	(71)
Water heating gains (Table 5)													
	41.4893	40.1746	37.4447	33.7334	31.3238	27.9311	25.0474	28.7422	30.0550	33.8963	38.2338	40.1801	(72)
Total internal gains													
	322.0413	320.6643	309.3891	290.9392	271.5471	253.4782	242.1572	245.9144	255.7725	274.3524	295.6725	312.2949	(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	
South	10.2200	46.7521	0.6300	0.7000	0.7700	146.0238	(78)

Solar gains	146.0238	239.1493	304.6338	344.3023	358.7843	345.2811	337.3606	327.6239	318.2259	257.9449	173.0879	126.1780	(83)
Total gains	468.0651	559.8136	614.0228	635.2415	630.3314	598.7592	579.5178	573.5383	573.9985	532.2973	468.7604	438.4729	(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	76.9377	77.1663	77.3917	78.4681	78.6728	79.6401	79.6401	79.8218	79.2647	78.6728	78.2598	77.8325	
alpha	6.1292	6.1444	6.1594	6.2312	6.2449	6.3093	6.3093	6.3215	6.2843	6.2449	6.2173	6.1888	
util living area													
	0.9969	0.9902	0.9743	0.9326	0.8372	0.6575	0.4787	0.5037	0.7264	0.9387	0.9914	0.9979	(86)
MIT	20.1489	20.3248	20.5294	20.7477	20.9064	20.9838	20.9980	20.9973	20.9695	20.7725	20.4141	20.1161	(87)
Th 2	20.1653	20.1676	20.1698	20.1803	20.1822	20.1914	20.1914	20.1931	20.1879	20.1822	20.1783	20.1741	(88)
util rest of house													
	0.9959	0.9873	0.9664	0.9120	0.7914	0.5828	0.3921	0.4172	0.6556	0.9158	0.9883	0.9972	(89)
MIT 2	19.3877	19.5638	19.7660	19.9817	20.1206	20.1840	20.1909	20.1923	20.1724	20.0093	19.6623	19.3624	(90)
Living area fraction										fLA = Living area / (4) =		0.3756	(91)
MIT	19.6736	19.8497	20.0527	20.2694	20.4158	20.4844	20.4941	20.4947	20.4718	20.2960	19.9447	19.6455	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6736	19.8497	20.0527	20.2694	20.4158	20.4844	20.4941	20.4947	20.4718	20.2960	19.9447	19.6455	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9858	0.9650	0.9145	0.8054	0.6106	0.4247	0.4498	0.6814	0.9194	0.9872	0.9966	(94)
Useful gains	465.7855	551.8912	592.5584	580.9246	507.6655	365.6065	246.1372	257.9778	391.1220	489.3962	462.7584	436.9844	(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													
	1008.5317	977.8148	883.8635	731.3035	559.1574	372.9289	246.7874	258.9114	405.7306	622.0413	828.3967	1001.6002	(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													
	403.8032	286.2207	216.7310	108.2728	38.3100	0.0000	0.0000	0.0000	0.0000	98.6880	263.2596	420.0742	(98)
Space heating												1835.3594	(98)
Space heating per m2											(98) / (4) =	25.2526	(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	595.7287	468.9779	480.5563	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9515	0.9815	0.9785	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	566.8619	460.2951	470.2381	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	786.2257	762.0358	756.6331	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	157.9420	224.4950	213.0779	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												595.5149	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	39.4855	56.1238	53.2695	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												148.8787	(107)
Space cooling per m2												2.0484	(108)
Energy for space heating												25.2526	(99)
Energy for space cooling												2.0484	(108)
Total												27.3010	(109)
Target Fabric Energy Efficiency (TFEE)												31.4	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.6800 (1b)	x	2.4000 (2b)	=	174.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.4320	(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			3.1800	
Infiltration rate			0.1590	(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) =		0.1232	(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	0.1294	0.1232	0.1232	0.1140	0.1140	0.1017	0.1047	0.0986	0.1017	0.1078	0.1078	0.1171	(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)			10.2200	1.2357	12.6293			(27)
WT-E-03	26.3800	10.2200	16.1600	0.1600	2.5856			(29a)
WT-I-02	22.2200	2.1200	20.1000	0.1584	3.1842			(29a)
WT-I-11	21.4800		21.4800	0.2719	5.8405			(29a)
Total net area of external elements Aum(A, m2)			70.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3596			(33)
Party Wall 1			16.4400	0.0000	0.0000			(32)
Party Floor 1			72.6800					(32d)
Party Ceilings 1			72.6800					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1748	(36)
Total fabric heat loss					(33) + (36) =		33.5344	(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	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	(38)
Heat transfer coeff	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	(39)
Average = Sum(39)m / 12 =												62.3157	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	(40)
HLP (average)												0.8574	(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	2.3094	(42)
Average daily hot water use (litres/day)	89.0480	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9529	94.3909	90.8290	87.2671	83.7052	80.1432	80.1432	83.7052	87.2671	90.8290	94.3909	97.9529	(44)
Energy conte	145.2613	127.0464	131.1005	114.2966	109.6703	94.6371	87.6952	100.6316	101.8334	118.6770	129.5453	140.6778	(45)
Energy content (annual)										Total = Sum(45)m =		1401.0725	(45)

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

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.7892	19.0570	19.6651	17.1445	16.4505	14.1956	13.1543	15.0947	15.2750	17.8016	19.4318	21.1017	(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	14.0981	12.7131	14.0423	13.5522	13.9769	13.4948	13.9252	13.9587	13.5261	14.0153	13.6063	14.0873	(61)
Total heat required for water heating calculated for each month	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(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	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(64)
								Total per year (kWh/year) = Sum(64)m =				1566.0688	(64)
RHI water heating demand												1566	(64)
Heat gains from water heating, kWh/month	51.8239	45.4212	47.1015	41.3917	39.9596	34.8406	32.6400	36.9497	37.2411	42.9639	46.4754	50.2972	(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	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.6043	43.1699	35.1081	26.5791	19.8682	16.7736	18.1244	23.5588	31.6206	40.1496	46.8605	49.9552	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6857	306.8371	298.8959	281.9900	260.6494	240.5922	227.1928	224.0415	231.9827	248.8885	270.2292	290.2863	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	(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)	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	(71)
Water heating gains (Table 5)	69.6558	67.5911	63.3085	57.4884	53.7091	48.3897	43.8709	49.6635	51.7238	57.7472	64.5491	67.6037	(72)
Total internal gains	522.2994	517.9516	497.6660	466.4111	434.5803	406.1090	389.5417	397.6174	415.6806	447.1389	481.9924	508.1988	(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	
South	10.2200	50.9848	0.4500	0.0000	0.7700	180.5490	(78)

Solar gains	180.5490	265.3663	333.3669	389.6318	398.2891	411.8829	397.3472	392.0371	377.7133	305.2939	219.0656	154.6394	(83)
Total gains	702.8483	783.3179	831.0329	856.0429	832.8694	817.9919	786.8890	789.6546	793.3940	752.4329	701.0580	662.8382	(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	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	
alpha	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	
util living area	0.9650	0.9355	0.8732	0.7581	0.5894	0.3804	0.2455	0.2525	0.4539	0.7373	0.9188	0.9734	(86)
MIT	20.5733	20.6904	20.8337	20.9416	20.9895	20.9995	21.0000	21.0000	20.9982	20.9577	20.7734	20.5282	(87)
Th 2	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	(88)
util rest of house	0.9558	0.9204	0.8466	0.7163	0.5342	0.3201	0.1824	0.1897	0.3924	0.6871	0.8974	0.9661	(89)
MIT 2	19.8361	19.9458	20.0751	20.1644	20.1984	20.2037	20.2039	20.2039	20.2032	20.1777	20.0245	19.7932	(90)
Living area fraction									fLA = Living area / (4) =			0.3756	(91)
MIT	20.1130	20.2255	20.3601	20.4563	20.4956	20.5026	20.5029	20.5029	20.5018	20.4707	20.3058	20.0693	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.9630	20.0755	20.2101	20.3063	20.3456	20.3526	20.3529	20.3529	20.3518	20.3207	20.1558	19.9193	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9526	0.9177	0.8469	0.7219	0.5442	0.3314	0.1942	0.2015	0.4039	0.6948	0.8959	0.9630	(94)
Useful gains	669.5392	718.8408	703.7603	617.9778	453.2166	271.0800	152.8504	159.0808	320.4550	522.7624	628.0913	638.3253	(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	926.2007	902.0498	798.2679	648.4776	457.7437	271.2351	152.8539	159.0853	321.0402	543.4345	757.4988	923.4761	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	190.9562	123.1164	70.3137	21.9598	3.3682	0.0000	0.0000	0.0000	0.0000	15.3801	93.1734	212.1521	(98)
Space heating												730.4198	(98)
RHI space heating demand												730	(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	72.6800 (1b)	x	2.4000 (2b)	=	174.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.4320	(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		3.1800	
Infiltration rate		0.1590	(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) =	0.1232	(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	0.1571	0.1540	0.1510	0.1355	0.1325	0.1171	0.1171	0.1140	0.1232	0.1325	0.1386	0.1448	(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-03	26.3800	10.2200	16.1600	0.1600	2.5856			(29a)
WT-I-02	22.2200	2.1200	20.1000	0.1584	3.1842			(29a)
WT-I-11	21.4800		21.4800	0.2719	5.8405			(29a)
Total net area of external elements Aum(A, m2)			70.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3596			(33)
Party Wall 1			16.4400	0.0000	0.0000			(32)
Party Floor 1			72.6800					(32d)
Party Ceilings 1			72.6800					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.1748	(36)
Total fabric heat loss (33) + (36) =	33.5344	(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	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	(38)
Heat transfer coeff	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	(39)
Average = Sum(39)m / 12 =												62.3157	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	(40)
HLP (average)												0.8574	(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	2.3094	(42)
Average daily hot water use (litres/day)	89.0480	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9529	94.3909	90.8290	87.2671	83.7052	80.1432	80.1432	83.7052	87.2671	90.8290	94.3909	97.9529	(44)
Energy conte	145.2613	127.0464	131.1005	114.2966	109.6703	94.6371	87.6952	100.6316	101.8334	118.6770	129.5453	140.6778	(45)
Energy content (annual)										Total = Sum(45)m =		1401.0725	(45)

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

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.7892	19.0570	19.6651	17.1445	16.4505	14.1956	13.1543	15.0947	15.2750	17.8016	19.4318	21.1017	(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	14.0981	12.7131	14.0423	13.5522	13.9769	13.4948	13.9252	13.9587	13.5261	14.0153	13.6063	14.0873	(61)
Total heat required for water heating calculated for each month													
	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(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													
	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(64)
								Total per year (kWh/year) = Sum(64)m =				1566.0688	(64)
Heat gains from water heating, kWh/month													
	51.8239	45.4212	47.1015	41.3917	39.9596	34.8406	32.6400	36.9497	37.2411	42.9639	46.4754	50.2972	(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	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.6043	43.1699	35.1081	26.5791	19.8682	16.7736	18.1244	23.5588	31.6206	40.1496	46.8605	49.9552	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	303.6857	306.8371	298.8959	281.9900	260.6494	240.5922	227.1928	224.0415	231.9827	248.8885	270.2292	290.2863	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	(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)													
	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	(71)
Water heating gains (Table 5)													
	69.6558	67.5911	63.3085	57.4884	53.7091	48.3897	43.8709	49.6635	51.7238	57.7472	64.5491	67.6037	(72)
Total internal gains													
	522.2994	517.9516	497.6660	466.4111	434.5803	406.1090	389.5417	397.6174	415.6806	447.1389	481.9924	508.1988	(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	
South	10.2200	46.7521	0.4500	0.0000	0.7700	165.5598	(78)

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	687.8592	789.0959	843.0558	856.7765	841.3652	797.5841	772.0368	769.0731	776.4810	739.5935	678.2372	651.2577	(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	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	
alpha	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	
util living area													
	0.9749	0.9447	0.8929	0.8039	0.6677	0.4971	0.3548	0.3723	0.5481	0.8016	0.9458	0.9813	(86)
MIT	20.4948	20.6481	20.7942	20.9109	20.9758	20.9968	20.9997	20.9996	20.9940	20.9246	20.6933	20.4434	(87)
Th 2	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	(88)
util rest of house													
	0.9683	0.9319	0.8704	0.7676	0.6173	0.4366	0.2908	0.3081	0.4872	0.7589	0.9308	0.9763	(89)
MIT 2	19.7603	19.9059	20.0398	20.1400	20.1895	20.2025	20.2038	20.2037	20.2011	20.1530	19.9510	19.7105	(90)
Living area fraction									fLA = Living area / (4) =			0.3756	(91)
MIT	20.0362	20.1847	20.3231	20.4296	20.4849	20.5008	20.5027	20.5027	20.4989	20.4429	20.2298	19.9858	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.8862	20.0347	20.1731	20.2796	20.3349	20.3508	20.3527	20.3527	20.3489	20.2929	20.0798	19.8358	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9652	0.9288	0.8694	0.7712	0.6258	0.4478	0.3028	0.3201	0.4985	0.7639	0.9282	0.9735	(94)
Useful gains	663.9336	732.9084	732.9556	660.7727	526.5647	357.1848	233.7762	246.1984	387.0471	564.9981	629.5191	633.9882	(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													
	971.2639	943.1278	852.0510	709.1265	538.0868	358.3674	233.8543	246.3130	389.4052	604.0179	808.8461	974.3534	(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													
	228.6537	141.2674	88.6070	34.8147	8.5724	0.0000	0.0000	0.0000	0.0000	29.0307	129.1155	253.2317	(98)
Space heating												913.2931	(98)
Space heating per m2											(98) / (4) =	12.5659	(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	1009.1636	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	228.6537	141.2674	88.6070	34.8147	8.5724	0.0000	0.0000	0.0000	0.0000	29.0307	129.1155	253.2317	(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)													
	252.6560	156.0966	97.9082	38.4693	9.4723	0.0000	0.0000	0.0000	0.0000	32.0782	142.6690	279.8140	(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													
	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.1578	88.8798	88.4860	87.9657	87.5006	87.3000	87.3000	87.3000	87.3000	87.8577	88.7888	89.2589	(217)
Fuel for water heating, kWh/month													
	178.7385	157.2455	164.0291	145.3393	141.3101	123.8625	116.4037	131.2603	132.1415	151.0310	161.2270	173.3889	(219)
Water heating fuel used												1775.9776	(219)
Annual totals kWh/year													
Space heating fuel - main system												1009.1636	(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)	39.1565	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1565	(231)
Electricity for lighting (calculated in Appendix L)	343.3468	(232)
Total delivered energy for all uses	3242.6446	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1009.1636	3.4800	35.1189	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1775.9776	3.4800	61.8040	(247)
Mechanical ventilation fans	39.1565	13.1900	5.1647	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	343.3468	13.1900	45.2874	(250)
Additional standing charges			120.0000	(251)
Total energy cost			277.2676	(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] =	0.9896	(257)
SAP value		86.1955	
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	1009.1636	0.2160	217.9793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1775.9776	0.2160	383.6112	(264)
Space and water heating			601.5905	(265)
Pumps and fans	114.1565	0.5190	59.2472	(267)
Energy for lighting	343.3468	0.5190	178.1970	(268)
Total kg/year			839.0347	(272)
CO2 emissions per m2			11.5400	(273)
EI value			90.4461	
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 / 0.8809 = 3.950, stars = 4
Water heating environmental impact	0.216 / 0.8809 = 0.2452, 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	72.6800 (1b)	x	2.4000 (2b)	=	174.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.6800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	174.4320	(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			3.1800	
Infiltration rate			0.1590	(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) =		0.1232	(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	0.1294	0.1232	0.1232	0.1140	0.1140	0.1017	0.1047	0.0986	0.1017	0.1078	0.1078	0.1171	(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)			10.2200	1.2357	12.6293			(27)
WT-E-03	26.3800	10.2200	16.1600	0.1600	2.5856			(29a)
WT-I-02	22.2200	2.1200	20.1000	0.1584	3.1842			(29a)
WT-I-11	21.4800		21.4800	0.2719	5.8405			(29a)
Total net area of external elements Aum(A, m2)			70.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.3596			(33)
Party Wall 1			16.4400	0.0000	0.0000			(32)
Party Floor 1			72.6800					(32d)
Party Ceilings 1			72.6800					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1748	(36)
Total fabric heat loss					(33) + (36) =		33.5344	(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	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	28.7813	(38)
Heat transfer coeff	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	62.3157	(39)
Average = Sum(39)m / 12 =												62.3157	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	0.8574	(40)
HLP (average)												0.8574	(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	2.3094	(42)
Average daily hot water use (litres/day)	89.0480	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.9529	94.3909	90.8290	87.2671	83.7052	80.1432	80.1432	83.7052	87.2671	90.8290	94.3909	97.9529	(44)
Energy conte	145.2613	127.0464	131.1005	114.2966	109.6703	94.6371	87.6952	100.6316	101.8334	118.6770	129.5453	140.6778	(45)
Energy content (annual)										Total = Sum(45)m =		1401.0725	(45)

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

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

	21.7892	19.0570	19.6651	17.1445	16.4505	14.1956	13.1543	15.0947	15.2750	17.8016	19.4318	21.1017	(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	14.0981	12.7131	14.0423	13.5522	13.9769	13.4948	13.9252	13.9587	13.5261	14.0153	13.6063	14.0873	(61)
Total heat required for water heating calculated for each month	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(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	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(64)
								Total per year (kWh/year) = Sum(64)m =				1566.0688	(64)
Heat gains from water heating, kWh/month	51.8239	45.4212	47.1015	41.3917	39.9596	34.8406	32.6400	36.9497	37.2411	42.9639	46.4754	50.2972	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	138.5635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.6043	43.1699	35.1081	26.5791	19.8682	16.7736	18.1244	23.5588	31.6206	40.1496	46.8605	49.9552	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6857	306.8371	298.8959	281.9900	260.6494	240.5922	227.1928	224.0415	231.9827	248.8885	270.2292	290.2863	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	51.1657	(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)	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	-92.3757	(71)
Water heating gains (Table 5)	69.6558	67.5911	63.3085	57.4884	53.7091	48.3897	43.8709	49.6635	51.7238	57.7472	64.5491	67.6037	(72)
Total internal gains	522.2994	517.9516	497.6660	466.4111	434.5803	406.1090	389.5417	397.6174	415.6806	447.1389	481.9924	508.1988	(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	
South	10.2200	50.9848	0.4500	0.0000	0.7700	180.5490	(78)

Solar gains	180.5490	265.3663	333.3669	389.6318	398.2891	411.8829	397.3472	392.0371	377.7133	305.2939	219.0656	154.6394	(83)
Total gains	702.8483	783.3179	831.0329	856.0429	832.8694	817.9919	786.8890	789.6546	793.3940	752.4329	701.0580	662.8382	(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	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	80.9944	
alpha	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	6.3996	
util living area	0.9650	0.9355	0.8732	0.7581	0.5894	0.3804	0.2455	0.2525	0.4539	0.7373	0.9188	0.9734	(86)
MIT	20.5733	20.6904	20.8337	20.9416	20.9895	20.9995	21.0000	21.0000	20.9982	20.9577	20.7734	20.5282	(87)
Th 2	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	20.2039	(88)
util rest of house	0.9558	0.9204	0.8466	0.7163	0.5342	0.3201	0.1824	0.1897	0.3924	0.6871	0.8974	0.9661	(89)
MIT 2	19.8361	19.9458	20.0751	20.1644	20.1984	20.2037	20.2039	20.2039	20.2032	20.1777	20.0245	19.7932	(90)
Living area fraction									fLA = Living area / (4) =			0.3756	(91)
MIT	20.1130	20.2255	20.3601	20.4563	20.4956	20.5026	20.5029	20.5029	20.5018	20.4707	20.3058	20.0693	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.9630	20.0755	20.2101	20.3063	20.3456	20.3526	20.3529	20.3529	20.3518	20.3207	20.1558	19.9193	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9526	0.9177	0.8469	0.7219	0.5442	0.3314	0.1942	0.2015	0.4039	0.6948	0.8959	0.9630	(94)
Useful gains	669.5392	718.8408	703.7603	617.9778	453.2166	271.0800	152.8504	159.0808	320.4550	522.7624	628.0913	638.3253	(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	926.2007	902.0498	798.2679	648.4776	457.7437	271.2351	152.8539	159.0853	321.0402	543.4345	757.4988	923.4761	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	190.9562	123.1164	70.3137	21.9598	3.3682	0.0000	0.0000	0.0000	0.0000	15.3801	93.1734	212.1521	(98)
Space heating												730.4198	(98)
Space heating per m2											(98) / (4) =	10.0498	(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	807.0937	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	190.9562	123.1164	70.3137	21.9598	3.3682	0.0000	0.0000	0.0000	0.0000	15.3801	93.1734	212.1521	(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)													
	211.0013	136.0402	77.6946	24.2650	3.7217	0.0000	0.0000	0.0000	0.0000	16.9946	102.9540	234.4222	(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													
	159.3593	139.7595	145.1429	127.8488	123.6472	108.1320	101.6205	114.5903	115.3595	132.6923	143.1515	154.7650	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.0157	88.7701	88.3191	87.7548	87.3819	87.3000	87.3000	87.3000	87.3000	87.6218	88.5342	89.1221	(217)
Fuel for water heating, kWh/month													
	179.0238	157.4399	164.3391	145.6886	141.5020	123.8625	116.4037	131.2603	132.1415	151.4375	161.6906	173.6551	(219)
Water heating fuel used												1778.4447	(219)

Annual totals kWh/year		
Space heating fuel - main system	807.0937	(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)	39.1565	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	114.1565	(231)
Electricity for lighting (calculated in Appendix L)	343.3468	(232)
Total delivered energy for all uses	3043.0418	(238)

10a. Fuel costs - using BEDF prices (478)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	807.0937	3.8700	31.2345	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1778.4447	3.8700	68.8258	(247)
Mechanical ventilation fans	39.1565	18.9000	7.4006	(249)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Energy for lighting	343.3468	18.9000	64.8925	(250)
Additional standing charges			93.0000	(251)
Total energy cost			279.5285	(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	807.0937	0.2160	174.3322	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1778.4447	0.2160	384.1441	(264)
Space and water heating			558.4763	(265)
Pumps and fans	114.1565	0.5190	59.2472	(267)
Energy for lighting	343.3468	0.5190	178.1970	(268)
Total kg/year			795.9205	(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	807.0937	1.2200	984.6544	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1778.4447	1.2200	2169.7026	(264)
Space and water heating			3154.3569	(265)
Pumps and fans	114.1565	3.0700	350.4604	(267)
Energy for lighting	343.3468	3.0700	1054.0746	(268)
Primary energy kWh/year			4558.8920	(272)
Primary energy kWh/m2/year			62.7255	(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 478 TEST (27 May 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£86	£86	£0
Mains gas	£193	£193	£0
Space heating	£146	£146	£0
Water heating	£69	£69	£0
Lighting	£65	£65	£0
Total cost of fuels	£279	£279	£0
Total cost of uses	£280	£280	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 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	North
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	345.38	(P1)
Transmission heat loss coefficient	33.53	(37)
Summer heat loss coefficient	378.91	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
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
South	10.2200	112.2060	0.4500	0.0000	0.9000	464.4318
total:						464.4318

	Jun	Jul	Aug	
Solar gains	481	464	458	(P4)
Internal gains	403	387	395	
Total summer gains	885	851	853	(P5)
Summer gain/loss ratio	2.33	2.25	2.25	(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	18.58	20.40	20.30	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant