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

Property Reference	SECPMW026v_059_As_Built	**Issued on Date**	07/05/2021
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	82 B	**DER**	20.90	**TER**	23.28
Environmental	86 B	**% DER<TER**	10.22		
CO_2 Emissions (t/year)	0.93	**DFEE**	51.65	**TFEE**	64.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.22		

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

---

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

---

DWELLING AS BUILT

Mid-floor flat, total floor area 52 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) 23.28 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.90 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)64.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.6 kWh/m²/yrOK

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.23 (max. 2.00)	1.30 (max. 3.30)	OK

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

---

3 Air permeability
Air permeability at 50 pascals: 3.85 (measured in this dwelling)
Maximum 10.0 OK

---

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

---

5 Cylinder insulation
Hot water storage No cylinder

---

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

Hot water controls: No cylinder

Boiler interlock Yes OK

---

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

---

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

---

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 6.42 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.9 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	51.5700 (1b)	x	2.4000 (2b)	=	123.7680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.5700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	123.7680	(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			3.8500	
Infiltration rate			0.1925	(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) =		0.1492	(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	0.1902	0.1865	0.1828	0.1641	0.1604	0.1417	0.1417	0.1380	0.1492	0.1604	0.1678	0.1753	(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)			6.4200	1.2357	7.9335			(27)
FT-03			51.5700	0.1300	6.7041			(28b)
WT-E-03	28.1600	6.4200	21.7400	0.1600	3.4784			(29a)
WT-I-02	30.2800	2.1200	28.1600	0.1584	4.4611			(29a)
WT-I-11	7.8700		7.8700	0.2719	2.1399			(29a)
Total net area of external elements Aum(A, m2)			117.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.8369			(33)
Party Wall 1			7.9500	0.0000	0.0000			(32)
Party Ceilings 1			51.5700					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.5011	(36)
Total fabric heat loss (33) + (36) =	41.3380	(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	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	(38)
Heat transfer coeff	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	(39)
Average = Sum(39)m / 12 =												61.7598	(39)
HLP	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	(40)
HLP (average)												1.1976	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7364	(42)
Average daily hot water use (litres/day)	75.4391	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.9831	79.9655	76.9479	73.9304	70.9128	67.8952	67.8952	70.9128	73.9304	76.9479	79.9655	82.9831	(44)
Energy conte	123.0615	107.6303	111.0649	96.8291	92.9098	80.1741	74.2931	85.2524	86.2706	100.5400	109.7473	119.1785	(45)
Energy content (annual)										Total = Sum(45)m =		1186.9514	(45)

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

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	18.4592	16.1446	16.6597	14.5244	13.9365	12.0261	11.1440	12.7879	12.9406	15.0810	16.4621	17.8768	(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	14.0016	12.6318	13.9617	13.4846	13.9147	13.4434	13.8776	13.9017	13.4659	13.9422	13.5234	13.9939	(61)
Total heat required for water heating calculated for each month	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(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	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(64)
								Total per year (kWh/year) = Sum(64)m =				1351.0940	(64)
Heat gains from water heating, kWh/month	44.4184	38.9451	40.4195	35.5668	34.3712	30.0187	28.1718	31.8218	32.0514	36.9151	39.8718	43.1253	(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	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8513	13.1908	10.7275	8.1214	6.0708	5.1253	5.5380	7.1985	9.6619	12.2679	14.3185	15.2641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.3103	152.8805	148.9238	140.5005	129.8676	119.8742	113.1980	111.6279	115.5845	124.0078	134.6407	144.6341	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	(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)	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	(71)
Water heating gains (Table 5)	59.7021	57.9539	54.3273	49.3983	46.1978	41.6927	37.8654	42.7713	44.5159	49.6171	55.3775	57.9641	(72)
Total internal gains	277.9095	276.0710	266.0243	250.0660	234.1820	218.7379	208.6472	213.6435	221.8080	237.9386	256.3825	269.9081	(73)

6. Solar gains

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

Solar gains	23.6543	45.2046	76.8136	123.3824	166.2074	177.9299	166.1203	131.7953	92.3549	53.8101	29.1806	19.7194	(83)
Total gains	301.5638	321.2756	342.8379	373.4484	400.3894	396.6678	374.7675	345.4387	314.1629	291.7488	285.5632	289.6275	(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	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	
alpha	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	
util living area	0.9687	0.9612	0.9446	0.9065	0.8326	0.7167	0.5958	0.6449	0.8170	0.9221	0.9587	0.9717	(86)
MIT	18.4805	18.6636	19.0517	19.6069	20.1786	20.6219	20.8349	20.7910	20.4224	19.7278	19.0073	18.4230	(87)
Th 2	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	(88)
util rest of house	0.9638	0.9550	0.9352	0.8889	0.7972	0.6478	0.4869	0.5406	0.7646	0.9040	0.9511	0.9673	(89)
MIT 2	17.6243	17.8057	18.1896	18.7333	19.2792	19.6775	19.8446	19.8170	19.5152	18.8587	18.1487	17.5675	(90)
Living area fraction									fLA = Living area / (4) =			0.4964	(91)
MIT	18.0493	18.2316	18.6175	19.1670	19.7256	20.1463	20.3362	20.3005	19.9656	19.2901	18.5749	17.9922	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8993	18.0816	18.4675	19.0170	19.5756	19.9963	20.1862	20.1505	19.8156	19.1401	18.4249	17.8422	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9515	0.9411	0.9189	0.8707	0.7839	0.6531	0.5160	0.5652	0.7585	0.8873	0.9369	0.9557	(94)
Useful gains	286.9376	302.3493	315.0194	325.1471	313.8501	259.0723	193.3941	195.2270	238.2869	258.8558	267.5450	276.8039	(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	839.8908	814.0913	739.1118	624.8212	486.3980	333.2728	221.4812	231.6320	352.9910	527.4348	699.4228	842.5372	(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	411.3972	343.8906	315.5247	215.7653	128.3757	0.0000	0.0000	0.0000	0.0000	199.8228	310.9521	420.9056	(98)
Space heating												2346.6340	(98)
Space heating per m2											(98) / (4) =	45.5039	(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	2592.9657	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	411.3972	343.8906	315.5247	215.7653	128.3757	0.0000	0.0000	0.0000	0.0000	199.8228	310.9521	420.9056	(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)													
	454.5825	379.9896	348.6461	238.4147	141.8515	0.0000	0.0000	0.0000	0.0000	220.7986	343.5935	465.0891	(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													
	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6785	89.6486	89.5683	89.3915	89.0180	87.3000	87.3000	87.3000	87.3000	89.3076	89.5680	89.7097	(217)
Fuel for water heating, kWh/month													
	152.8383	134.1485	139.5880	123.4051	120.0032	107.2366	100.9974	113.5785	114.2456	128.1887	137.6282	148.4482	(219)
Water heating fuel used												1520.3062	(219)

Annual totals kWh/year

Space heating fuel - main system	2592.9657	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	27.7834	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	102.7834	(231)
Electricity for lighting (calculated in Appendix L)	262.2789	(232)
Total delivered energy for all uses	4478.3342	(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	2592.9657	0.2160	560.0806	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1520.3062	0.2160	328.3861	(264)
Space and water heating			888.4667	(265)
Pumps and fans	102.7834	0.5190	53.3446	(267)
Energy for lighting	262.2789	0.5190	136.1227	(268)
Total CO2, kg/year			1077.9341	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.9000	(273)

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

DER		20.9000	ZC1
Total Floor Area	TFA	51.5700	
Assumed number of occupants	N	1.7364	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3867	ZC2
CO2 emissions from cooking, equation (L16)		3.1156	ZC3
Total CO2 emissions		41.4024	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		41.4024	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	51.5700 (1b)	x	2.4000 (2b)	=	123.7680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.5700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	123.7680	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1616	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4116	(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) =	0.3190	(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	0.4067	0.3987	0.3908	0.3509	0.3429	0.3030	0.3030	0.2951	0.3190	0.3429	0.3589	0.3748	(22b)
Effective ac	0.5827	0.5795	0.5763	0.5616	0.5588	0.5459	0.5459	0.5435	0.5509	0.5588	0.5644	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			6.4200	1.3258	8.5114			(27)
FT-03			51.5700	0.1300	6.7041			(28b)
WT-E-03	28.1600	6.4200	21.7400	0.1800	3.9132			(29a)
WT-I-02	30.2800	2.1200	28.1600	0.1800	5.0688			(29a)
WT-I-11	7.8700		7.8700	0.1800	1.4166			(29a)
Total net area of external elements Aum(A, m2)			117.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7341			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2262	(36)
Total fabric heat loss					(33) + (36) =		40.9603	(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	23.7997	23.6685	23.5399	22.9360	22.8230	22.2971	22.2971	22.1996	22.4997	22.8230	23.0516	23.2906	(38)
Heat transfer coeff	64.7599	64.6287	64.5002	63.8963	63.7833	63.2573	63.2573	63.1599	63.4599	63.7833	64.0119	64.2508	(39)
Average = Sum(39)m / 12 =												63.8957	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2558	1.2532	1.2507	1.2390	1.2368	1.2266	1.2266	1.2247	1.2306	1.2368	1.2413	1.2459	(40)
HLP (average)												1.2390	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7364	(42)
Average daily hot water use (litres/day)	75.4391	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.9831	79.9655	76.9479	73.9304	70.9128	67.8952	67.8952	70.9128	73.9304	76.9479	79.9655	82.9831	(44)
Energy conte	123.0615	107.6303	111.0649	96.8291	92.9098	80.1741	74.2931	85.2524	86.2706	100.5400	109.7473	119.1785	(45)
Energy content (annual)										Total = Sum(45)m =		1186.9514	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4592	16.1446	16.6597	14.5244	13.9365	12.0261	11.1440	12.7879	12.9406	15.0810	16.4621	17.8768	(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													

CALCULATION OF TARGET EMISSIONS 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	(57)
Combi loss	42.2873	36.8060	39.2118	36.4588	36.1364	33.4826	34.5987	36.1364	36.4588	39.2118	39.4350	42.2873	(61)
Total heat required for water heating calculated for each month													
	165.3487	144.4364	150.2767	133.2879	129.0462	113.6567	108.8917	121.3888	122.7294	139.7518	149.1823	161.4657	(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													
	165.3487	144.4364	150.2767	133.2879	129.0462	113.6567	108.8917	121.3888	122.7294	139.7518	149.1823	161.4657	(64)
								Total per year (kWh/year) = Sum(64)m =				1639.4622	(64)
Heat gains from water heating, kWh/month													
	51.4898	44.9886	46.7320	41.3104	39.9266	35.0285	33.3521	37.3805	37.7997	43.2325	46.3497	50.1987	(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	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.8513	13.1908	10.7275	8.1214	6.0708	5.1253	5.5380	7.1985	9.6619	12.2679	14.3185	15.2641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.3103	152.8805	148.9238	140.5005	129.8676	119.8742	113.1980	111.6279	115.5845	124.0078	134.6407	144.6341	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	(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)													
	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	(71)
Water heating gains (Table 5)													
	69.2067	66.9473	62.8119	57.3755	53.6648	48.6507	44.8281	50.2426	52.4995	58.1082	64.3746	67.4713	(72)
Total internal gains													
	287.4141	285.0644	274.5089	258.0432	241.6490	225.6960	215.6099	221.1148	229.7917	246.4298	265.3796	279.4153	(73)

6. Solar gains

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

Solar gains	20.8631	39.8704	67.7496	108.8233	146.5949	156.9342	146.5181	116.2434	81.4570	47.4605	25.7373	17.3925	(83)
Total gains	308.2772	324.9348	342.2585	366.8664	388.2439	382.6301	362.1280	337.3582	311.2487	293.8903	291.1169	296.8078	(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	55.3004	55.4126	55.5231	56.0479	56.1471	56.6140	56.6140	56.7013	56.4333	56.1471	55.9467	55.7386	
alpha	4.6867	4.6942	4.7015	4.7365	4.7431	4.7743	4.7743	4.7801	4.7622	4.7431	4.7298	4.7159	
util living area													
	0.9980	0.9971	0.9944	0.9844	0.9493	0.8493	0.7038	0.7600	0.9338	0.9882	0.9966	0.9984	(86)
MIT	19.6174	19.7192	19.9361	20.2617	20.5973	20.8565	20.9579	20.9387	20.7358	20.3314	19.9258	19.5984	(87)
Th 2	19.8756	19.8777	19.8796	19.8889	19.8906	19.8988	19.8988	19.9003	19.8956	19.8906	19.8871	19.8835	(88)
util rest of house													
	0.9973	0.9960	0.9922	0.9774	0.9232	0.7680	0.5579	0.6225	0.8876	0.9816	0.9951	0.9978	(89)
MIT 2	18.0406	18.1907	18.5087	18.9871	19.4600	19.7900	19.8813	19.8711	19.6550	19.0921	18.4996	18.0182	(90)
Living area fraction									fLA = Living area / (4) =			0.4964	(91)
MIT	18.8233	18.9495	19.2173	19.6198	20.0246	20.3194	20.4157	20.4011	20.1915	19.7073	19.2076	18.8026	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8233	18.9495	19.2173	19.6198	20.0246	20.3194	20.4157	20.4011	20.1915	19.7073	19.2076	18.8026	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9948	0.9904	0.9752	0.9270	0.8029	0.6311	0.6909	0.9027	0.9801	0.9939	0.9970	(94)
Useful gains	307.1633	323.2532	338.9616	357.7606	359.9119	307.2093	228.5335	233.0754	280.9516	288.0399	289.3396	295.9150	(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													
	940.5300	907.9989	820.2653	684.9558	530.9689	361.7968	241.3716	252.7075	386.5681	580.8944	775.0312	938.2290	(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													
	471.2248	392.9491	358.0900	235.5806	127.2664	0.0000	0.0000	0.0000	0.0000	217.8837	349.6980	477.8816	(98)
Space heating												2630.5741	(98)
Space heating per m2											(98) / (4) =	51.0098	(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	2816.4605	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	471.2248	392.9491	358.0900	235.5806	127.2664	0.0000	0.0000	0.0000	0.0000	217.8837	349.6980	477.8816	(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)	504.5233	420.7164	383.3940	252.2276	136.2596	0.0000	0.0000	0.0000	0.0000	233.2802	374.4090	511.6505	(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	165.3487	144.4364	150.2767	133.2879	129.0462	113.6567	108.8917	121.3888	122.7294	139.7518	149.1823	161.4657	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5400	87.4439	87.1593	86.4700	85.0163	80.3000	80.3000	80.3000	80.3000	86.1650	87.1231	87.6168	(217)
Fuel for water heating, kWh/month	188.8836	165.1761	172.4161	154.1434	151.7900	141.5400	135.6061	151.1691	152.8386	162.1910	171.2316	184.2862	(219)
Water heating fuel used												1931.2718	(219)

Annual totals kWh/year		
Space heating fuel - main system	2816.4605	(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)	262.2789	(232)
Total delivered energy for all uses	5085.0112	(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	2816.4605	0.2160	608.3555	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1931.2718	0.2160	417.1547	(264)
Space and water heating			1025.5102	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	262.2789	0.5190	136.1227	(268)
Total CO2, kg/m2/year			1200.5579	(272)
Emissions per m2 for space and water heating			19.8858	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6396	(272b)
Emissions per m2 for pumps and fans			0.7548	(272c)
Target Carbon Dioxide Emission Rate (TER) = (19.8858 * 1.00) + 2.6396 + 0.7548, rounded to 2 d.p.			23.2800	(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	51.5700 (1b)	x	2.4000 (2b)	=	123.7680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.5700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	123.7680	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1616	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3541	(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) =	0.2744	(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	0.3499	0.3430	0.3362	0.3019	0.2950	0.2607	0.2607	0.2538	0.2744	0.2950	0.3087	0.3224	(22b)
Effective ac	0.5612	0.5588	0.5565	0.5456	0.5435	0.5340	0.5340	0.5322	0.5377	0.5435	0.5477	0.5520	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			6.4200	1.2357	7.9335			(27)
FT-03			51.5700	0.1300	6.7041			(28b)
WT-E-03	28.1600	6.4200	21.7400	0.1600	3.4784			(29a)
WT-I-02	30.2800	2.1200	28.1600	0.1584	4.4611			(29a)
WT-I-11	7.8700		7.8700	0.2719	2.1399			(29a)
Total net area of external elements Aum(A, m2)			117.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8369			(33)
Party Wall 1			7.9500	0.0000	0.0000			(32)
Party Ceilings 1			51.5700					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.5011	(36)
Total fabric heat loss (33) + (36) =	41.3380	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.9218	22.8247	22.7295	22.2826	22.1990	21.8097	21.8097	21.7376	21.9596	22.1990	22.3681	22.5450	(38)
Heat transfer coeff	64.2598	64.1627	64.0676	63.6206	63.5370	63.1477	63.1477	63.0756	63.2977	63.5370	63.7062	63.8830	(39)
Average = Sum(39)m / 12 =												63.6202	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2461	1.2442	1.2423	1.2337	1.2321	1.2245	1.2245	1.2231	1.2274	1.2321	1.2353	1.2388	(40)
HLP (average)												1.2337	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7364	(42)
Average daily hot water use (litres/day)	75.4391	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.9831	79.9655	76.9479	73.9304	70.9128	67.8952	67.8952	70.9128	73.9304	76.9479	79.9655	82.9831	(44)
Energy conte	123.0615	107.6303	111.0649	96.8291	92.9098	80.1741	74.2931	85.2524	86.2706	100.5400	109.7473	119.1785	(45)
Energy content (annual)										Total = Sum(45)m =		1186.9514	(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													
	26.1506	22.8714	23.6013	20.5762	19.7433	17.0370	15.7873	18.1161	18.3325	21.3648	23.3213	25.3254	(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	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.8513	13.1908	10.7275	8.1214	6.0708	5.1253	5.5380	7.1985	9.6619	12.2679	14.3185	15.2641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.3103	152.8805	148.9238	140.5005	129.8676	119.8742	113.1980	111.6279	115.5845	124.0078	134.6407	144.6341	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	(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)													
	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	(71)
Water heating gains (Table 5)													
	35.1486	34.0349	31.7222	28.5780	26.5367	23.6625	21.2195	24.3496	25.4618	28.7161	32.3907	34.0395	(72)
Total internal gains													
	250.3560	249.1519	240.4192	226.2457	211.5210	197.7077	189.0013	192.2218	199.7540	214.0376	230.3957	242.9835	(73)

6. Solar gains

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

Solar gains	23.6543	45.2046	76.8136	123.3824	166.2074	177.9299	166.1203	131.7953	92.3549	53.8101	29.1806	19.7194	(83)
Total gains	274.0103	294.3565	317.2328	349.6281	377.7283	375.6376	355.1216	324.0171	292.1088	267.8478	259.5763	262.7029	(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	22.2923	22.3260	22.3592	22.5163	22.5459	22.6849	22.6849	22.7108	22.6312	22.5459	22.4860	22.4238	
alpha	2.4862	2.4884	2.4906	2.5011	2.5031	2.5123	2.5123	2.5141	2.5087	2.5031	2.4991	2.4949	
util living area													
	0.9748	0.9682	0.9536	0.9191	0.8513	0.7409	0.6233	0.6749	0.8403	0.9352	0.9666	0.9773	(86)
MIT	18.2975	18.4904	18.8970	19.4901	20.0927	20.5751	20.8092	20.7586	20.3546	19.6179	18.8646	18.2557	(87)
Th 2	19.8833	19.8848	19.8863	19.8932	19.8944	19.9004	19.9004	19.9016	19.8981	19.8944	19.8918	19.8891	(88)
util rest of house													
	0.9707	0.9629	0.9454	0.9032	0.8179	0.6730	0.5118	0.5697	0.7911	0.9194	0.9602	0.9736	(89)
MIT 2	17.4177	17.6101	18.0140	18.6016	19.1813	19.6238	19.8104	19.7791	19.4396	18.7347	17.9884	17.3801	(90)
Living area fraction									fLA = Living area / (4) =			0.4964	(91)
MIT	17.8545	18.0471	18.4523	19.0427	19.6337	20.0960	20.3062	20.2653	19.8938	19.1731	18.4234	17.8148	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8545	18.0471	18.4523	19.0427	19.6337	20.0960	20.3062	20.2653	19.8938	19.1731	18.4234	17.8148	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9606	0.9514	0.9316	0.8879	0.8086	0.6865	0.5565	0.6083	0.7909	0.9062	0.9488	0.9642	(94)
Useful gains	263.2256	280.0389	295.5358	310.4507	305.4421	257.8615	197.6284	197.0865	231.0265	242.7249	246.2853	253.3106	(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													
	871.0079	843.5548	765.7564	645.2823	504.0840	347.0606	234.0372	243.8059	366.7355	544.7120	721.3695	869.7551	(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													
	452.1901	378.6827	349.8441	241.0788	147.7896	0.0000	0.0000	0.0000	0.0000	224.6784	342.0606	458.6347	(98)
Space heating												2594.9589	(98)
Space heating per m2											(98) / (4) =	50.3192	(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	593.5885	467.2931	479.3747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6556	0.7249	0.6882	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	389.1843	338.7248	329.9281	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	505.2448	480.0657	444.8835	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	83.5635	105.1577	85.5268	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												274.2480	(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	20.8909	26.2894	21.3817	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling													68.5620 (107)
Space cooling per m2													1.3295 (108)
Energy for space heating													50.3192 (99)
Energy for space cooling													1.3295 (108)
Total													51.6487 (109)
Dwelling Fabric Energy Efficiency (DFEE)													51.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.5700 (1b)	x	2.4000 (2b)	=	123.7680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.5700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	123.7680	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1616	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4116	(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) =	0.3190	(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	0.4067	0.3987	0.3908	0.3509	0.3429	0.3030	0.3030	0.2951	0.3190	0.3429	0.3589	0.3748	(22b)
Effective ac	0.5827	0.5795	0.5763	0.5616	0.5588	0.5459	0.5459	0.5435	0.5509	0.5588	0.5644	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			6.4200	1.3258	8.5114			(27)
FT-03			51.5700	0.1300	6.7041			(28b)
WT-E-03	28.1600	6.4200	21.7400	0.1800	3.9132			(29a)
WT-I-02	30.2800	2.1200	28.1600	0.1800	5.0688			(29a)
WT-I-11	7.8700		7.8700	0.1800	1.4166			(29a)
Total net area of external elements Aum(A, m2)			117.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7341			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2262	(36)
Total fabric heat loss					(33) + (36) =		40.9603	(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	23.7997	23.6685	23.5399	22.9360	22.8230	22.2971	22.2971	22.1996	22.4997	22.8230	23.0516	23.2906	(38)
Heat transfer coeff	64.7599	64.6287	64.5002	63.8963	63.7833	63.2573	63.2573	63.1599	63.4599	63.7833	64.0119	64.2508	(39)
Average = Sum(39)m / 12 =												63.8957	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2558	1.2532	1.2507	1.2390	1.2368	1.2266	1.2266	1.2247	1.2306	1.2368	1.2413	1.2459	(40)
HLP (average)												1.2390	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7364	(42)
Average daily hot water use (litres/day)	75.4391	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.9831	79.9655	76.9479	73.9304	70.9128	67.8952	67.8952	70.9128	73.9304	76.9479	79.9655	82.9831	(44)
Energy conte	123.0615	107.6303	111.0649	96.8291	92.9098	80.1741	74.2931	85.2524	86.2706	100.5400	109.7473	119.1785	(45)
Energy content (annual)										Total = Sum(45)m =		1186.9514	(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													

CALCULATION OF TARGET 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	(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													
	26.1506	22.8714	23.6013	20.5762	19.7433	17.0370	15.7873	18.1161	18.3325	21.3648	23.3213	25.3254	(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	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	86.8192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.8513	13.1908	10.7275	8.1214	6.0708	5.1253	5.5380	7.1985	9.6619	12.2679	14.3185	15.2641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	151.3103	152.8805	148.9238	140.5005	129.8676	119.8742	113.1980	111.6279	115.5845	124.0078	134.6407	144.6341	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	31.6819	(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)													
	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	(71)
Water heating gains (Table 5)													
	35.1486	34.0349	31.7222	28.5780	26.5367	23.6625	21.2195	24.3496	25.4618	28.7161	32.3907	34.0395	(72)
Total internal gains													
	250.3560	249.1519	240.4192	226.2457	211.5210	197.7077	189.0013	192.2218	199.7540	214.0376	230.3957	242.9835	(73)

---

6. Solar gains

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

Solar gains	20.8631	39.8704	67.7496	108.8233	146.5949	156.9342	146.5181	116.2434	81.4570	47.4605	25.7373	17.3925	(83)
Total gains	271.2191	289.0224	308.1688	335.0690	358.1159	354.6419	335.5194	308.4652	281.2110	261.4982	256.1330	260.3760	(84)

---

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	55.3004	55.4126	55.5231	56.0479	56.1471	56.6140	56.6140	56.7013	56.4333	56.1471	55.9467	55.7386	
alpha	4.6867	4.6942	4.7015	4.7365	4.7431	4.7743	4.7743	4.7801	4.7622	4.7431	4.7298	4.7159	
util living area													
	0.9989	0.9982	0.9964	0.9891	0.9617	0.8767	0.7418	0.8013	0.9529	0.9926	0.9980	0.9991	(86)
MIT	19.5517	19.6558	19.8766	20.2084	20.5540	20.8313	20.9471	20.9221	20.6951	20.2761	19.8640	19.5336	(87)
Th 2	19.8756	19.8777	19.8796	19.8889	19.8906	19.8988	19.8988	19.9003	19.8956	19.8906	19.8871	19.8835	(88)
util rest of house													
	0.9984	0.9976	0.9949	0.9840	0.9408	0.8027	0.5959	0.6683	0.9167	0.9884	0.9972	0.9987	(89)
MIT 2	18.5573	18.6627	18.8846	19.2215	19.5581	19.8080	19.8831	19.8735	19.6982	19.2916	18.8784	18.5453	(90)
Living area fraction										fLA = Living area / (4) =		0.4964	(91)
MIT	19.0509	19.1557	19.3770	19.7114	20.0524	20.3160	20.4113	20.3940	20.1930	19.7803	19.3677	19.0359	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0509	19.1557	19.3770	19.7114	20.0524	20.3160	20.4113	20.3940	20.1930	19.7803	19.3677	19.0359	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9970	0.9940	0.9830	0.9445	0.8347	0.6695	0.7349	0.9288	0.9878	0.9966	0.9984	(94)
Useful gains	270.6871	288.1622	306.3301	329.3742	338.2434	296.0289	224.6468	226.6950	261.1820	258.3050	255.2692	259.9597	(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													
	955.2687	921.3273	830.5712	690.8085	532.7467	361.5776	241.0906	252.2620	386.6641	585.5523	785.2766	953.2190	(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													
	509.3287	425.4869	390.0354	260.2327	144.7104	0.0000	0.0000	0.0000	0.0000	243.4720	381.6053	515.7849	(98)
Space heating												2870.6563	(98)
Space heating per m2											(98) / (4) =	55.6652	(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	594.6188	468.1041	480.0153	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7291	0.8169	0.7750	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	433.5231	382.3891	372.0165	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	480.7043	457.1541	426.7061	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	33.9705	55.6252	40.6891	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												130.2847	(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	8.4926	13.9063	10.1723	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												32.5712	(107)
Space cooling per m2												0.6316	(108)
Energy for space heating												55.6652	(99)
Energy for space cooling												0.6316	(108)
Total												56.2968	(109)
Target Fabric Energy Efficiency (TFEE)												64.7	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.5700 (1b)	x	2.4000 (2b)	=	123.7680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.5700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	123.7680	(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			3.8500	
Infiltration rate			0.1925	(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) =		0.1492	(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	0.1566	0.1492	0.1492	0.1380	0.1380	0.1231	0.1268	0.1194	0.1231	0.1305	0.1305	0.1417	(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)			6.4200	1.2357	7.9335			(27)
FT-03			51.5700	0.1300	6.7041			(28b)
WT-E-03	28.1600	6.4200	21.7400	0.1600	3.4784			(29a)
WT-I-02	30.2800	2.1200	28.1600	0.1584	4.4611			(29a)
WT-I-11	7.8700		7.8700	0.2719	2.1399			(29a)
Total net area of external elements Aum(A, m2)			117.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8369			(33)
Party Wall 1			7.9500	0.0000	0.0000			(32)
Party Ceilings 1			51.5700					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5011	(36)
Total fabric heat loss					(33) + (36) =		41.3380	(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	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	(38)
Heat transfer coeff	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	(39)
Average = Sum(39)m / 12 =												61.7598	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	(40)
HLP (average)												1.1976	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7364	(42)
Average daily hot water use (litres/day)	75.4391	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.9831	79.9655	76.9479	73.9304	70.9128	67.8952	67.8952	70.9128	73.9304	76.9479	79.9655	82.9831	(44)
Energy conte	123.0615	107.6303	111.0649	96.8291	92.9098	80.1741	74.2931	85.2524	86.2706	100.5400	109.7473	119.1785	(45)
Energy content (annual)										Total = Sum(45)m =		1186.9514	(45)

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

CALCULATION OF HEAT DEMAND 09 Jan 2014

	18.4592	16.1446	16.6597	14.5244	13.9365	12.0261	11.1440	12.7879	12.9406	15.0810	16.4621	17.8768	(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	14.0016	12.6318	13.9617	13.4846	13.9147	13.4434	13.8776	13.9017	13.4659	13.9422	13.5234	13.9939	(61)
Total heat required for water heating calculated for each month	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(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	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(64)
								Total per year (kWh/year) = Sum(64)m =				1351.0940	(64)
RHI water heating demand												1351	(64)
Heat gains from water heating, kWh/month	44.4184	38.9451	40.4195	35.5668	34.3712	30.0187	28.1718	31.8218	32.0514	36.9151	39.8718	43.1253	(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	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.1283	32.9770	26.8187	20.3035	15.1771	12.8131	13.8451	17.9963	24.1546	30.6699	35.7963	38.1602	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.8363	228.1798	222.2743	209.7022	193.8323	178.9167	168.9522	166.6088	172.5142	185.0863	200.9563	215.8718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	(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)	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	(71)
Water heating gains (Table 5)	59.7021	57.9539	54.3273	49.3983	46.1978	41.6927	37.8654	42.7713	44.5159	49.6171	55.3775	57.9641	(72)
Total internal gains	407.5491	403.9932	388.3027	364.2865	340.0896	318.3050	305.5451	312.2588	326.0671	350.2556	377.0125	396.8786	(73)

---

6. Solar gains

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

Solar gains	26.6531	46.2413	78.4165	130.3669	170.8487	195.3851	180.5989	146.8414	102.4689	59.0255	33.7711	21.9503	(83)
Total gains	434.2022	450.2344	466.7192	494.6534	510.9383	513.6901	486.1439	459.1001	428.5361	409.2812	410.7836	418.8289	(84)

---

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	
alpha	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	
util living area	0.9261	0.9156	0.8863	0.8231	0.7059	0.5226	0.3707	0.4003	0.6512	0.8295	0.9023	0.9311	(86)
MIT	19.0237	19.1635	19.5472	20.0512	20.5453	20.8625	20.9617	20.9528	20.7302	20.1785	19.5269	18.9824	(87)
Th 2	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	(88)
util rest of house	0.9153	0.9032	0.8685	0.7931	0.6515	0.4320	0.2508	0.2770	0.5709	0.7942	0.8855	0.9210	(89)
MIT 2	18.1566	18.2933	18.6677	19.1495	19.5995	19.8528	19.9119	19.9087	19.7619	19.2781	18.6522	18.1167	(90)
Living area fraction									fLA = Living area / (4) =			0.4964	(91)
MIT	18.5870	18.7253	19.1043	19.5971	20.0690	20.3540	20.4331	20.4270	20.2426	19.7251	19.0864	18.5465	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4370	18.5753	18.9543	19.4471	19.9190	20.2040	20.2831	20.2770	20.0926	19.5751	18.9364	18.3965	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8967	0.8840	0.8492	0.7778	0.6514	0.4572	0.2925	0.3194	0.5849	0.7809	0.8667	0.9028	(94)
Useful gains	389.3598	398.0294	396.3313	384.7597	332.8044	234.8373	142.2085	146.6352	250.6362	319.5991	356.0248	378.1387	(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	823.6913	801.3493	713.5894	589.6266	427.3149	259.6399	147.1768	152.9770	302.1640	492.5372	675.4300	821.1866	(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	323.1426	271.0309	236.0400	147.5042	70.3158	0.0000	0.0000	0.0000	0.0000	128.6660	229.9718	329.6277	(98)
Space heating												1736.2992	(98)
RHI space heating demand												1736	(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	51.5700 (1b)	x	2.4000 (2b)	=	123.7680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.5700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	123.7680	(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			3.8500	
Infiltration rate			0.1925	(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) =		0.1492	(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	0.1902	0.1865	0.1828	0.1641	0.1604	0.1417	0.1417	0.1380	0.1492	0.1604	0.1678	0.1753	(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)			6.4200	1.2357	7.9335			(27)
FT-03			51.5700	0.1300	6.7041			(28b)
WT-E-03	28.1600	6.4200	21.7400	0.1600	3.4784			(29a)
WT-I-02	30.2800	2.1200	28.1600	0.1584	4.4611			(29a)
WT-I-11	7.8700		7.8700	0.2719	2.1399			(29a)
Total net area of external elements Aum(A, m2)			117.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8369			(33)
Party Wall 1			7.9500	0.0000	0.0000			(32)
Party Ceilings 1			51.5700					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5011	(36)
Total fabric heat loss					(33) + (36) =		41.3380	(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	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	(38)
Heat transfer coeff	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	(39)
Average = Sum(39)m / 12 =												61.7598	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	(40)
HLP (average)												1.1976	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7364	(42)
Average daily hot water use (litres/day)	75.4391	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.9831	79.9655	76.9479	73.9304	70.9128	67.8952	67.8952	70.9128	73.9304	76.9479	79.9655	82.9831	(44)
Energy conte	123.0615	107.6303	111.0649	96.8291	92.9098	80.1741	74.2931	85.2524	86.2706	100.5400	109.7473	119.1785	(45)
Energy content (annual)										Total = Sum(45)m =		1186.9514	(45)

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

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	18.4592	16.1446	16.6597	14.5244	13.9365	12.0261	11.1440	12.7879	12.9406	15.0810	16.4621	17.8768	(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	14.0016	12.6318	13.9617	13.4846	13.9147	13.4434	13.8776	13.9017	13.4659	13.9422	13.5234	13.9939	(61)
Total heat required for water heating calculated for each month	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(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	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(64)
								Total per year (kWh/year) = Sum(64)m =				1351.0940	(64)
Heat gains from water heating, kWh/month	44.4184	38.9451	40.4195	35.5668	34.3712	30.0187	28.1718	31.8218	32.0514	36.9151	39.8718	43.1253	(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	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.1283	32.9770	26.8187	20.3035	15.1771	12.8131	13.8451	17.9963	24.1546	30.6699	35.7963	38.1602	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	225.8363	228.1798	222.2743	209.7022	193.8323	178.9167	168.9522	166.6088	172.5142	185.0863	200.9563	215.8718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	(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)	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	(71)
Water heating gains (Table 5)	59.7021	57.9539	54.3273	49.3983	46.1978	41.6927	37.8654	42.7713	44.5159	49.6171	55.3775	57.9641	(72)
Total internal gains	407.5491	403.9932	388.3027	364.2865	340.0896	318.3050	305.5451	312.2588	326.0671	350.2556	377.0125	396.8786	(73)

6. Solar gains

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

Solar gains	23.6543	45.2046	76.8136	123.3824	166.2074	177.9299	166.1203	131.7953	92.3549	53.8101	29.1806	19.7194	(83)
Total gains	431.2034	449.1977	465.1163	487.6689	506.2969	496.2349	471.6654	444.0540	418.4220	404.0658	406.1931	416.5979	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	
alpha	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	
util living area	0.9338	0.9229	0.8995	0.8497	0.7617	0.6325	0.5063	0.5468	0.7245	0.8587	0.9157	0.9390	(86)
MIT	18.8572	19.0241	19.3738	19.8654	20.3568	20.7226	20.8877	20.8593	20.5809	19.9935	19.3419	18.7970	(87)
Th 2	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	(88)
util rest of house	0.9245	0.9119	0.8843	0.8251	0.7191	0.5603	0.4038	0.4457	0.6617	0.8307	0.9018	0.9303	(89)
MIT 2	17.9924	18.1561	18.4986	18.9733	19.4321	19.7494	19.8719	19.8552	19.6402	19.1038	18.4715	17.9336	(90)
Living area fraction									fLA = Living area / (4) =			0.4964	(91)
MIT	18.4217	18.5870	18.9331	19.4162	19.8911	20.2325	20.3761	20.3536	20.1071	19.5455	18.9036	18.3622	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2717	18.4370	18.7831	19.2662	19.7411	20.0825	20.2261	20.2036	19.9571	19.3955	18.7536	18.2122	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9065	0.8931	0.8648	0.8075	0.7111	0.5720	0.4345	0.4740	0.6640	0.8145	0.8831	0.9129	(94)
Useful gains	390.8815	401.1564	402.2430	393.8103	360.0043	283.8412	204.9441	210.4916	277.8493	329.0947	358.7146	380.2997	(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	862.8888	836.0393	758.5999	640.2118	496.6181	338.5995	223.9498	234.9107	361.7360	543.2063	719.7221	865.3904	(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	351.1734	292.2414	265.1295	177.4090	101.6407	0.0000	0.0000	0.0000	0.0000	159.2990	259.9254	360.9075	(98)
Space heating												1967.7260	(98)
Space heating per m2											(98) / (4) =	38.1564	(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	2174.2829	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	351.1734	292.2414	265.1295	177.4090	101.6407	0.0000	0.0000	0.0000	0.0000	159.2990	259.9254	360.9075	(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)	388.0370	322.9186	292.9608	196.0321	112.3102	0.0000	0.0000	0.0000	0.0000	176.0210	287.2104	398.7928	(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	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5782	89.5431	89.4493	89.2458	88.8314	87.3000	87.3000	87.3000	87.3000	89.1338	89.4453	89.6146	(217)
Fuel for water heating, kWh/month	153.0094	134.3065	139.7736	123.6066	120.2552	107.2366	100.9974	113.5785	114.2456	128.4387	137.8169	148.6056	(219)
Water heating fuel used												1521.8706	(219)

Annual totals kWh/year		
Space heating fuel - main system	2174.2829	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)	27.7834	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	102.7834	(231)
Electricity for lighting (calculated in Appendix L)	262.2789	(232)
Total delivered energy for all uses	4061.2159	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2174.2829	3.4800	75.6650	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1521.8706	3.4800	52.9611	(247)
Mechanical ventilation fans	27.7834	13.1900	3.6646	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	262.2789	13.1900	34.5946	(250)
Additional standing charges			120.0000	(251)
Total energy cost			296.7779	(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] =	1.2907	(257)
SAP value		81.9942	
SAP rating (Section 12)		82	(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	2174.2829	0.2160	469.6451	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1521.8706	0.2160	328.7241	(264)
Space and water heating			798.3692	(265)
Pumps and fans	102.7834	0.5190	53.3446	(267)
Energy for lighting	262.2789	0.5190	136.1227	(268)
Total kg/year			987.8365	(272)
CO2 emissions per m2			19.1600	(273)
EI value			86.2928	
EI rating			86	(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 / 0.8867 = 3.925, stars = 4
Water heating environmental impact	0.216 / 0.8867 = 0.2436, 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	51.5700 (1b)	x	2.4000 (2b)	=	123.7680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.5700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	123.7680	(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			3.8500	
Infiltration rate			0.1925	(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) =		0.1492	(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	0.1566	0.1492	0.1492	0.1380	0.1380	0.1231	0.1268	0.1194	0.1231	0.1305	0.1305	0.1417	(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)			6.4200	1.2357	7.9335			(27)
FT-03			51.5700	0.1300	6.7041			(28b)
WT-E-03	28.1600	6.4200	21.7400	0.1600	3.4784			(29a)
WT-I-02	30.2800	2.1200	28.1600	0.1584	4.4611			(29a)
WT-I-11	7.8700		7.8700	0.2719	2.1399			(29a)
Total net area of external elements Aum(A, m2)			117.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.8369			(33)
Party Wall 1			7.9500	0.0000	0.0000			(32)
Party Ceilings 1			51.5700					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.5011	(36)
Total fabric heat loss					(33) + (36) =		41.3380	(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	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	20.4217	(38)
Heat transfer coeff	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	61.7598	(39)
Average = Sum(39)m / 12 =												61.7598	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	1.1976	(40)
HLP (average)												1.1976	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7364	(42)
Average daily hot water use (litres/day)	75.4391	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.9831	79.9655	76.9479	73.9304	70.9128	67.8952	67.8952	70.9128	73.9304	76.9479	79.9655	82.9831	(44)
Energy conte	123.0615	107.6303	111.0649	96.8291	92.9098	80.1741	74.2931	85.2524	86.2706	100.5400	109.7473	119.1785	(45)
Energy content (annual)										Total = Sum(45)m =		1186.9514	(45)

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

	18.4592	16.1446	16.6597	14.5244	13.9365	12.0261	11.1440	12.7879	12.9406	15.0810	16.4621	17.8768	(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	14.0016	12.6318	13.9617	13.4846	13.9147	13.4434	13.8776	13.9017	13.4659	13.9422	13.5234	13.9939	(61)
Total heat required for water heating calculated for each month													
	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(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													
	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(64)
								Total per year (kWh/year) = Sum(64)m =				1351.0940	(64)
Heat gains from water heating, kWh/month													
	44.4184	38.9451	40.4195	35.5668	34.3712	30.0187	28.1718	31.8218	32.0514	36.9151	39.8718	43.1253	(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	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	104.1831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	37.1283	32.9770	26.8187	20.3035	15.1771	12.8131	13.8451	17.9963	24.1546	30.6699	35.7963	38.1602	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	225.8363	228.1798	222.2743	209.7022	193.8323	178.9167	168.9522	166.6088	172.5142	185.0863	200.9563	215.8718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	47.1547	(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)													
	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	-69.4554	(71)
Water heating gains (Table 5)													
	59.7021	57.9539	54.3273	49.3983	46.1978	41.6927	37.8654	42.7713	44.5159	49.6171	55.3775	57.9641	(72)
Total internal gains													
	407.5491	403.9932	388.3027	364.2865	340.0896	318.3050	305.5451	312.2588	326.0671	350.2556	377.0125	396.8786	(73)

---

6. Solar gains

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

Solar gains	26.6531	46.2413	78.4165	130.3669	170.8487	195.3851	180.5989	146.8414	102.4689	59.0255	33.7711	21.9503	(83)
Total gains	434.2022	450.2344	466.7192	494.6534	510.9383	513.6901	486.1439	459.1001	428.5361	409.2812	410.7836	418.8289	(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	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	23.1947	
alpha	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	2.5463	
util living area													
	0.9261	0.9156	0.8863	0.8231	0.7059	0.5226	0.3707	0.4003	0.6512	0.8295	0.9023	0.9311	(86)
MIT	19.0237	19.1635	19.5472	20.0512	20.5453	20.8625	20.9617	20.9528	20.7302	20.1785	19.5269	18.9824	(87)
Th 2	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	19.9219	(88)
util rest of house													
	0.9153	0.9032	0.8685	0.7931	0.6515	0.4320	0.2508	0.2770	0.5709	0.7942	0.8855	0.9210	(89)
MIT 2	18.1566	18.2933	18.6677	19.1495	19.5995	19.8528	19.9119	19.9087	19.7619	19.2781	18.6522	18.1167	(90)
Living area fraction									fLA = Living area / (4) =			0.4964	(91)
MIT	18.5870	18.7253	19.1043	19.5971	20.0690	20.3540	20.4331	20.4270	20.2426	19.7251	19.0864	18.5465	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4370	18.5753	18.9543	19.4471	19.9190	20.2040	20.2831	20.2770	20.0926	19.5751	18.9364	18.3965	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8967	0.8840	0.8492	0.7778	0.6514	0.4572	0.2925	0.3194	0.5849	0.7809	0.8667	0.9028	(94)
Useful gains	389.3598	398.0294	396.3313	384.7597	332.8044	234.8373	142.2085	146.6352	250.6362	319.5991	356.0248	378.1387	(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													
	823.6913	801.3493	713.5894	589.6266	427.3149	259.6399	147.1768	152.9770	302.1640	492.5372	675.4300	821.1866	(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													
	323.1426	271.0309	236.0400	147.5042	70.3158	0.0000	0.0000	0.0000	0.0000	128.6660	229.9718	329.6277	(98)
Space heating												1736.2992	(98)
Space heating per m2											(98) / (4) =	33.6688	(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	1918.5626	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	323.1426	271.0309	236.0400	147.5042	70.3158	0.0000	0.0000	0.0000	0.0000	128.6660	229.9718	329.6277	(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)	357.0637	299.4817	260.8177	162.9881	77.6971	0.0000	0.0000	0.0000	0.0000	142.1724	254.1125	364.2295	(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	137.0631	120.2622	125.0265	110.3137	106.8245	93.6175	88.1707	99.1540	99.7364	114.4823	123.2707	133.1724	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5227	89.4918	89.3657	89.1025	88.5428	87.3000	87.3000	87.3000	87.3000	88.9646	89.3570	89.5554	(217)
Fuel for water heating, kWh/month	153.1044	134.3835	139.9044	123.8053	120.6473	107.2366	100.9974	113.5785	114.2456	128.6829	137.9531	148.7039	(219)
Water heating fuel used												1523.2428	(219)

Annual totals kWh/year		
Space heating fuel - main system	1918.5626	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)	27.7834	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	102.7834	(231)
Electricity for lighting (calculated in Appendix L)	262.2789	(232)
Total delivered energy for all uses	3806.8677	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1918.5626	3.8700	74.2484	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1523.2428	3.8700	58.9495	(247)
Mechanical ventilation fans	27.7834	18.9000	5.2511	(249)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Energy for lighting	262.2789	18.9000	49.5707	(250)
Additional standing charges			93.0000	(251)
Total energy cost			295.1947	(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	1918.5626	0.2160	414.4095	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1523.2428	0.2160	329.0204	(264)
Space and water heating			743.4300	(265)
Pumps and fans	102.7834	0.5190	53.3446	(267)
Energy for lighting	262.2789	0.5190	136.1227	(268)
Total kg/year			932.8973	(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	1918.5626	1.2200	2340.6464	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1523.2428	1.2200	1858.3562	(264)
Space and water heating			4199.0026	(265)
Pumps and fans	102.7834	3.0700	315.5452	(267)
Energy for lighting	262.2789	3.0700	805.1962	(268)
Primary energy kWh/year			5319.7440	(272)
Primary energy kWh/m2/year			103.1558	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 82
Current environmental impact rating:	B 86

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 82
Potential environmental impact rating: B 86

Fuel prices for cost data on this page from database revision number 476 TEST (01 Apr 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£69	£69	£0
Mains gas	£226	£226	£0
Space heating	£187	£187	£0
Water heating	£59	£59	£0
Lighting	£50	£50	£0
Total cost of fuels	£295	£295	£0
Total cost of uses	£296	£296	£0
Delivered energy	74 kWh/m²	74 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	18 kg/m²	18 kg/m²	0 kg/m²
Primary energy	103 kWh/m²	103 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable


-----------------------------------------------------------------------------------------------------
```

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

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

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	245.06	(P1)
Transmission heat loss coefficient	41.34	(37)
Summer heat loss coefficient	286.40	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.4200	81.1852	0.4500	0.0000	0.9000	211.0896
total:						211.0896

	Jun	Jul	Aug	
Solar gains	228	211	172	(P4)
Internal gains	315	303	309	
Total summer gains	544	514	481	(P5)
Summer gain/loss ratio	1.90	1.79	1.68	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.20	20.99	20.78	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight