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

Property Reference	SECPMW025n_079_As_Built	**Issued on Date**	22/11/2021
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	85 B	**DER**	14.98	**TER**	16.02
Environmental	89 B	**% DER<TER**	6.52		
CO_2 Emissions (t/year)	0.92	**DFEE**	33.76	**TFEE**	36.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.36		

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

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

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 76 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) 16.02 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.98 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)36.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.29 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.24 (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: 3.22 (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 East: 9.04 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	75.5400 (1b)	x	2.4000 (2b)	=	181.2960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	181.2960	(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		3.2200	
Infiltration rate		0.1610	(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) =	0.1248	(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	0.1591	0.1560	0.1528	0.1373	0.1341	0.1185	0.1185	0.1154	0.1248	0.1341	0.1404	0.1466	(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)			9.0400	1.2357	11.1711			(27)
WT-E-01	32.6600	9.0400	23.6200	0.2000	4.7240			(29a)
WT-I-01	40.3000	2.1200	38.1800	0.2890	11.0337			(29a)
Total net area of external elements Aum(A, m2)			72.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0488			(33)
Party Wall 1			15.1200	0.0000	0.0000			(32)
Party Floor 1			75.5400					(32d)
Party Ceilings 1			75.5400					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0492	(36)
Total fabric heat loss (33) + (36) =	36.0980	(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	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	(38)
Heat transfer coeff	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	(39)
Average = Sum(39)m / 12 =												66.0118	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	(40)
HLP (average)												0.8739	(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	2.3728	(42)
Average daily hot water use (litres/day)	90.5539	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.6093	95.9872	92.3650	88.7428	85.1207	81.4985	81.4985	85.1207	88.7428	92.3650	95.9872	99.6093	(44)
Energy conte	147.7177	129.1949	133.3175	116.2295	111.5249	96.2375	89.1782	102.3333	103.5555	120.6840	131.7360	143.0567	(45)
Energy content (annual)										Total = Sum(45)m =		1424.7658	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1577	19.3792	19.9976	17.4344	16.7287	14.4356	13.3767	15.3500	15.5333	18.1026	19.7604	21.4585	(46)

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Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     14.1097    12.7229    14.0521    13.5603    13.9844    13.5010    13.9310    13.9656    13.5334    14.0241    13.6163    14.0986 (61)
Total heat required for water heating calculated for each month
              161.8274   141.9178   147.3696   129.7898   125.5093   109.7386   103.1092   116.2989   117.0889   134.7080   145.3522   157.1553 (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
              161.8274   141.9178   147.3696   129.7898   125.5093   109.7386   103.1092   116.2989   117.0889   134.7080   145.3522   157.1553 (64)
                                                                                                 Total per year (kWh/year) = Sum(64)m =   1589.8651 (64)
Heat gains from water heating, kWh/month
               52.6436    46.1380    47.8411    42.0364    40.5781    35.3742    33.1345    37.5172    37.8155    43.6334    47.2063    51.0910 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m        118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              20.7799    18.4565    15.0098    11.3634     8.4943     7.1712     7.7488    10.0721    13.5188    17.1652    20.0344    21.3574 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             209.8678   212.0456   206.5577   194.8746   180.1267   166.2659   157.0059   154.8282   160.3161   171.9992   186.7470   200.6079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640 (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)
             -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119 (71)
Water heating gains (Table 5)
              70.7575    68.6578    64.3026    58.3839    54.5405    49.1309    44.5356    50.4264    52.5216    58.6471    65.5643    68.6707 (72)
Total internal gains
             362.9972   360.7518   347.4621   326.2138   304.7535   284.1599   270.8823   276.9186   287.9484   309.4035   333.9376   352.2280 (73)


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6. Solar gains
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[Jan]                                      Area        Solar flux              g              FF          Access            Gains
                                            m2          Table 6a      Specific data     Specific data     factor              W
                                                          W/m2       or Table 6b       or Table 6c     Table 6d
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East                                     9.0400          19.6403          0.4500          0.0000          0.7700          61.5204 (76)
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Solar gains    61.5204   120.3469   198.1942   289.0544   354.2471   362.6349   345.2432   296.5588   230.5081   142.8017    76.7087    50.5914 (83)
Total gains   424.5175   481.0988   545.6563   615.2683   659.0006   646.7948   616.1255   573.4775   518.4565   452.2052   410.6463   402.8194 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            79.4681    79.4681    79.4681    79.4681    79.4681    79.4681    79.4681    79.4681    79.4681    79.4681    79.4681    79.4681
alpha           6.2979     6.2979     6.2979     6.2979     6.2979     6.2979     6.2979     6.2979     6.2979     6.2979     6.2979     6.2979
util living area
                0.9985     0.9963     0.9873     0.9478     0.8306     0.6370     0.4692     0.5249     0.8013     0.9742     0.9965     0.9989 (86)

MIT            20.1117    20.2362    20.4522    20.7178    20.9129    20.9863    20.9982    20.9966    20.9476    20.6780    20.3345    20.0750 (87)
Th 2           20.1898    20.1898    20.1898    20.1898    20.1898    20.1898    20.1898    20.1898    20.1898    20.1898    20.1898    20.1898 (88)
util rest of house
                0.9980     0.9951     0.9831     0.9307     0.7843     0.5632     0.3840     0.4349     0.7338     0.9624     0.9951     0.9986 (89)
MIT 2          19.3713    19.4952    19.7090    19.9638    20.1327    20.1836    20.1893    20.1888    20.1616    19.9308    19.5936    19.3346 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.3548 (91)
MIT            19.6340    19.7581    19.9727    20.2313    20.4095    20.4684    20.4763    20.4754    20.4404    20.1959    19.8564    19.5972 (92)
Temperature adjustment                                                                                                          -0.1500
adjusted MIT   19.4840    19.6081    19.8227    20.0813    20.2595    20.3184    20.3263    20.3254    20.2904    20.0459    19.7064    19.4472 (93)


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8. Space heating requirement
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                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9974     0.9939     0.9806     0.9281     0.7886     0.5753     0.3985     0.4502     0.7429     0.9598     0.9940     0.9981 (94)
Useful gains  423.4219   478.1666   535.0826   571.0022   519.7045   372.0842   245.5237   258.1632   385.1784   434.0351   408.1987   402.0626 (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
             1002.3214   970.9059   879.4528   738.0987   565.0285   377.4806   245.9795   259.1201   408.6409   623.5396   832.1737  1006.4985 (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
              430.7013   331.1208   256.2114   120.3095    33.7211     0.0000     0.0000     0.0000     0.0000   140.9914   305.2621   449.7003 (98)
Space heating                                                                                                                      2068.0178 (98)
Space heating per m2                                                                                                 (98) / (4) =    27.3765 (99)


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8c. Space cooling requirement
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Not applicable
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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	2285.1025	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	430.7013	331.1208	256.2114	120.3095	33.7211	0.0000	0.0000	0.0000	0.0000	140.9914	305.2621	449.7003	(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)	475.9130	365.8794	283.1065	132.9387	37.2608	0.0000	0.0000	0.0000	0.0000	155.7916	337.3061	496.9064	(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	161.8274	141.9178	147.3696	129.7898	125.5093	109.7386	103.1092	116.2989	117.0889	134.7080	145.3522	157.1553	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6030	89.5156	89.3047	88.8106	87.9587	87.3000	87.3000	87.3000	87.3000	88.9077	89.4425	89.6490	(217)
Fuel for water heating, kWh/month	180.6050	158.5397	165.0189	146.1422	142.6913	125.7028	118.1091	133.2176	134.1224	151.5145	162.5092	175.3006	(219)
Water heating fuel used												1793.4734	(219)

Annual totals kWh/year

Space heating fuel - main system	2285.1025	(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)	40.6973	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	115.6973	(231)
Electricity for lighting (calculated in Appendix L)	366.9792	(232)
Total delivered energy for all uses	4561.2525	(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	2285.1025	0.2160	493.5821	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1793.4734	0.2160	387.3903	(264)
Space and water heating			880.9724	(265)
Pumps and fans	115.6973	0.5190	60.0469	(267)
Energy for lighting	366.9792	0.5190	190.4622	(268)
Total CO2, kg/year			1131.4815	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9800	(273)

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

DER		14.9800	ZC1
Total Floor Area	TFA	75.5400	
Assumed number of occupants	N	2.3728	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4632	ZC2
CO2 emissions from cooking, equation (L16)		2.3292	ZC3
Total CO2 emissions		33.7724	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.7724	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	75.5400 (1b)	x	2.4000 (2b)	=	181.2960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.5400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.2960	(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) =	0.1655	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4155	(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) =	0.3220	(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	0.4105	0.4025	0.3944	0.3542	0.3461	0.3059	0.3059	0.2978	0.3220	0.3461	0.3622	0.3783	(22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716	(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)			9.0400	1.3258	11.9848			(27)
WT-E-01	32.6600	9.0400	23.6200	0.1800	4.2516			(29a)
WT-I-01	40.3000	2.1200	38.1800	0.1800	6.8724			(29a)
Total net area of external elements Aum(A, m2)			72.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.2288			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0535	(36)
Total fabric heat loss					(33) + (36) =		31.2823	(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	34.9556	34.7599	34.5680	33.6666	33.4980	32.7129	32.7129	32.5675	33.0153	33.4980	33.8391	34.1958	(38)
Heat transfer coeff	66.2380	66.0422	65.8503	64.9490	64.7803	63.9953	63.9953	63.8499	64.2976	64.7803	65.1215	65.4781	(39)
Average = Sum(39)m / 12 =												64.9481	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8769	0.8743	0.8717	0.8598	0.8576	0.8472	0.8472	0.8452	0.8512	0.8576	0.8621	0.8668	(40)
HLP (average)												0.8598	(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	2.3728	(42)
Average daily hot water use (litres/day)	90.5539	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.6093	95.9872	92.3650	88.7428	85.1207	81.4985	81.4985	85.1207	88.7428	92.3650	95.9872	99.6093	(44)
Energy conte	147.7177	129.1949	133.3175	116.2295	111.5249	96.2375	89.1782	102.3333	103.5555	120.6840	131.7360	143.0567	(45)
Energy content (annual)										Total = Sum(45)m =		1424.7658	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1577	19.3792	19.9976	17.4344	16.7287	14.4356	13.3767	15.3500	15.5333	18.1026	19.7604	21.4585	(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	50.7598	44.1804	47.0682	43.7636	43.3766	40.1911	41.5308	43.3766	43.7636	47.0682	47.3361	50.7598	(61)

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Total heat required for water heating calculated for each month													
	198.4775	173.3753	180.3857	159.9930	154.9015	136.4286	130.7090	145.7099	147.3191	167.7521	179.0721	193.8165	(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													
	198.4775	173.3753	180.3857	159.9930	154.9015	136.4286	130.7090	145.7099	147.3191	167.7521	179.0721	193.8165	(64)
								Total per year (kWh/year) = Sum(64)m =				1967.9404	(64)
Heat gains from water heating, kWh/month													
	61.8061	54.0024	56.0951	49.5872	47.9262	42.0467	40.0344	44.8700	45.3731	51.8945	55.6362	60.2563	(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	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.7799	18.4565	15.0098	11.3634	8.4943	7.1712	7.7488	10.0721	13.5188	17.1652	20.0344	21.3574	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	209.8678	212.0456	206.5577	194.8746	180.1267	166.2659	157.0059	154.8282	160.3161	171.9992	186.7470	200.6079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	(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)													
	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	(71)
Water heating gains (Table 5)													
	83.0727	80.3607	75.3967	68.8711	64.4169	58.3983	53.8097	60.3091	63.0182	69.7506	77.2726	80.9897	(72)
Total internal gains													
	375.3124	372.4548	358.5562	336.7010	314.6299	293.4273	280.1564	286.8014	298.4450	320.5070	345.6459	364.5470	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.0400	19.6403	0.6300	0.7000	0.7700	54.2610	(76)

Solar gains	54.2610	106.1460	174.8073	254.9460	312.4459	319.8440	304.5045	261.5649	203.3081	125.9511	67.6571	44.6216	(83)
Total gains	429.5734	478.6007	533.3635	591.6471	627.0758	613.2713	584.6609	548.3662	501.7532	446.4581	413.3030	409.1685	(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	79.1967	79.4315	79.6630	80.7686	80.9788	81.9722	81.9722	82.1589	81.5867	80.9788	80.5546	80.1158	
alpha	6.2798	6.2954	6.3109	6.3846	6.3986	6.4648	6.4648	6.4773	6.4391	6.3986	6.3703	6.3411	
util living area													
	0.9984	0.9964	0.9886	0.9540	0.8469	0.6507	0.4794	0.5312	0.8069	0.9745	0.9963	0.9988	(86)
MIT	20.1139	20.2324	20.4401	20.7093	20.9063	20.9862	20.9983	20.9968	20.9490	20.6866	20.3526	20.0937	(87)
Th 2	20.1872	20.1894	20.1916	20.2018	20.2037	20.2126	20.2126	20.2143	20.2092	20.2037	20.1999	20.1958	(88)
util rest of house													
	0.9979	0.9952	0.9848	0.9385	0.8029	0.5779	0.3948	0.4428	0.7409	0.9630	0.9949	0.9984	(89)
MIT 2	18.9921	19.1667	19.4697	19.8581	20.1126	20.2034	20.2120	20.2129	20.1687	19.8341	19.3507	18.9692	(90)
Living area fraction									fLA = Living area / (4) =			0.3548	(91)
MIT	19.3901	19.5448	19.8140	20.1601	20.3942	20.4811	20.4909	20.4910	20.4455	20.1366	19.7061	19.3682	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3901	19.5448	19.8140	20.1601	20.3942	20.4811	20.4909	20.4910	20.4455	20.1366	19.7061	19.3682	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9939	0.9825	0.9376	0.8142	0.6033	0.4249	0.4743	0.7621	0.9618	0.9937	0.9979	(94)
Useful gains	428.3520	475.6999	524.0440	554.7297	510.5945	370.0081	248.4268	260.0862	382.3762	429.4213	410.6944	408.2979	(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													
	999.5352	967.1734	876.7306	731.3330	563.2102	376.3645	249.0015	261.2122	408.0023	617.7811	820.9295	993.1841	(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													
	424.9603	330.2702	262.3988	127.1544	39.1461	0.0000	0.0000	0.0000	0.0000	140.1397	295.3693	435.1553	(98)
Space heating												2054.5941	(98)
Space heating per m2											(98) / (4) =	27.1988	(99)

8c. Space cooling requirement

Not applicable

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

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2199.7795	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	424.9603	330.2702	262.3988	127.1544	39.1461	0.0000	0.0000	0.0000	0.0000	140.1397	295.3693	435.1553	(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)	454.9896	353.6083	280.9409	136.1396	41.9123	0.0000	0.0000	0.0000	0.0000	150.0425	316.2412	465.9050	(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	198.4775	173.3753	180.3857	159.9930	154.9015	136.4286	130.7090	145.7099	147.3191	167.7521	179.0721	193.8165	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.9195	86.6483	85.9936	84.4796	82.1516	80.3000	80.3000	80.3000	80.3000	84.6023	86.3029	87.0270	(217)
Fuel for water heating, kWh/month	228.3464	200.0908	209.7664	189.3867	188.5556	169.8986	162.7758	181.4569	183.4609	198.2833	207.4926	222.7086	(219)
Water heating fuel used												2342.2225	(219)

Annual totals kWh/year		
Space heating fuel - main system	2199.7795	(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)	366.9792	(232)
Total delivered energy for all uses	4983.9813	(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	2199.7795	0.2160	475.1524	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2342.2225	0.2160	505.9201	(264)
Space and water heating			981.0724	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	366.9792	0.5190	190.4622	(268)
Total CO2, kg/m2/year			1210.4597	(272)
Emissions per m2 for space and water heating			12.9875	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5213	(272b)
Emissions per m2 for pumps and fans			0.5153	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.9875 * 1.00) + 2.5213 + 0.5153, rounded to 2 d.p.			16.0200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.5400 (1b)	x	2.4000 (2b)	=	181.2960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.5400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.2960	(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) =	0.1655	(8)
Pressure test		Yes	
Measured/design AP50		3.2200	
Infiltration rate		0.3265	(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) =	0.2530	(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	0.3226	0.3163	0.3099	0.2783	0.2720	0.2404	0.2404	0.2340	0.2530	0.2720	0.2846	0.2973	(22b)
Effective ac	0.5520	0.5500	0.5480	0.5387	0.5370	0.5289	0.5289	0.5274	0.5320	0.5370	0.5405	0.5442	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			9.0400	1.2357	11.1711			(27)
WT-E-01	32.6600	9.0400	23.6200	0.2000	4.7240			(29a)
WT-I-01	40.3000	2.1200	38.1800	0.2890	11.0337			(29a)
Total net area of external elements Aum(A, m2)			72.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0488			(33)
Party Wall 1			15.1200	0.0000	0.0000			(32)
Party Floor 1			75.5400					(32d)
Party Ceilings 1			75.5400					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0492	(36)
Total fabric heat loss (33) + (36) =	36.0980	(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	33.0270	32.9061	32.7876	32.2310	32.1269	31.6422	31.6422	31.5524	31.8289	32.1269	32.3376	32.5578	(38)
Heat transfer coeff	69.1249	69.0041	68.8856	68.3290	68.2249	67.7401	67.7401	67.6504	67.9269	68.2249	68.4355	68.6558	(39)
Average = Sum(39)m / 12 =												68.3285	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9151	0.9135	0.9119	0.9045	0.9032	0.8967	0.8967	0.8956	0.8992	0.9032	0.9060	0.9089	(40)
HLP (average)												0.9045	(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	2.3728	(42)
Average daily hot water use (litres/day)	90.5539	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.6093	95.9872	92.3650	88.7428	85.1207	81.4985	81.4985	85.1207	88.7428	92.3650	95.9872	99.6093	(44)
Energy conte	147.7177	129.1949	133.3175	116.2295	111.5249	96.2375	89.1782	102.3333	103.5555	120.6840	131.7360	143.0567	(45)
Energy content (annual)										Total = Sum(45)m =		1424.7658	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.3900	27.4539	28.3300	24.6988	23.6990	20.4505	18.9504	21.7458	22.0055	25.6453	27.9939	30.3996	(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	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	118.6398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.7799	18.4565	15.0098	11.3634	8.4943	7.1712	7.7488	10.0721	13.5188	17.1652	20.0344	21.3574	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.8678	212.0456	206.5577	194.8746	180.1267	166.2659	157.0059	154.8282	160.3161	171.9992	186.7470	200.6079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	34.8640	(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)	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	(71)
Water heating gains (Table 5)	42.1909	40.8540	38.0779	34.3038	31.8536	28.4034	25.4709	29.2283	30.5633	34.4695	38.8804	40.8596	(72)
Total internal gains	331.4306	329.9481	318.2374	299.1338	279.0665	260.4325	248.8176	252.7205	262.9901	282.2259	304.2538	321.4169	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.0400	19.6403	0.4500	0.0000	0.7700	61.5204	(76)

Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)
Total gains	392.9509	450.2950	516.4316	588.1882	633.3136	623.0674	594.0608	549.2793	493.4982	425.0277	380.9624	372.0083	(84)

7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	75.8892	76.0221	76.1529	76.7732	76.8903	77.4406	77.4406	77.5433	77.2277	76.8903	76.6537	76.4078	
alpha	6.0593	6.0681	6.0769	6.1182	6.1260	6.1627	6.1627	6.1696	6.1485	6.1260	6.1102	6.0939	
util living area	0.9990	0.9975	0.9911	0.9606	0.8605	0.6713	0.4981	0.5590	0.8370	0.9822	0.9978	0.9993	(86)
MIT	20.0105	20.1402	20.3671	20.6593	20.8834	20.9801	20.9972	20.9946	20.9275	20.6198	20.2569	19.9835	(87)
Th 2	20.1547	20.1561	20.1574	20.1636	20.1648	20.1703	20.1703	20.1713	20.1682	20.1648	20.1624	20.1600	(88)
util rest of house	0.9987	0.9967	0.9880	0.9466	0.8171	0.5944	0.4062	0.4623	0.7724	0.9735	0.9969	0.9991	(89)
MIT 2	19.2410	19.3714	19.5979	19.8866	20.0867	20.1612	20.1695	20.1697	20.1278	19.8540	19.4935	19.2184	(90)
Living area fraction									fLA = Living area / (4) =			0.3548	(91)
MIT	19.5140	19.6442	19.8708	20.1608	20.3693	20.4517	20.4632	20.4624	20.4115	20.1257	19.7643	19.4899	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5140	19.6442	19.8708	20.1608	20.3693	20.4517	20.4632	20.4624	20.4115	20.1257	19.7643	19.4899	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9960	0.9867	0.9466	0.8286	0.6214	0.4389	0.4968	0.7931	0.9730	0.9963	0.9988	(94)
Useful gains	392.3185	448.5047	509.5747	556.7588	524.7933	387.1512	260.7532	272.8917	391.3705	413.5641	379.5518	371.5764	(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	1051.6659	1017.4067	921.0528	769.4368	591.4647	396.3976	261.6922	274.8207	428.7201	649.8869	866.6887	1049.7368	(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	490.5544	382.3022	306.1398	153.1281	49.6035	0.0000	0.0000	0.0000	0.0000	175.8241	350.7386	504.5513	(98)
Space heating												2412.8421	(98)
Space heating per m2											(98) / (4) =	31.9413	(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	636.7573	501.2770	514.1428	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9431	0.9758	0.9633	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	600.5033	489.1464	495.2523	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	817.4140	781.7766	731.1881	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	156.1757	217.7169	175.5363	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												549.4289	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	39.0439	54.4292	43.8841	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												137.3572	(107)
Space cooling per m2												1.8183	(108)
Energy for space heating												31.9413	(99)
Energy for space cooling												1.8183	(108)
Total												33.7596	(109)
Dwelling Fabric Energy Efficiency (DFEE)												33.8	(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	75.5400 (1b)	x	2.4000 (2b)	=	181.2960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.5400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.2960	(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) =	0.1655	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4155	(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) =	0.3220	(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	0.4105	0.4025	0.3944	0.3542	0.3461	0.3059	0.3059	0.2978	0.3220	0.3461	0.3622	0.3783	(22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716	(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)			9.0400	1.3258	11.9848			(27)
WT-E-01	32.6600	9.0400	23.6200	0.1800	4.2516			(29a)
WT-I-01	40.3000	2.1200	38.1800	0.1800	6.8724			(29a)
Total net area of external elements Aum(A, m2)			72.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.2288			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0535	(36)
Total fabric heat loss					(33) + (36) =		31.2823	(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	34.9556	34.7599	34.5680	33.6666	33.4980	32.7129	32.7129	32.5675	33.0153	33.4980	33.8391	34.1958	(38)
Heat transfer coeff	66.2380	66.0422	65.8503	64.9490	64.7803	63.9953	63.9953	63.8499	64.2976	64.7803	65.1215	65.4781	(39)
Average = Sum(39)m / 12 =												64.9481	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8769	0.8743	0.8717	0.8598	0.8576	0.8472	0.8472	0.8452	0.8512	0.8576	0.8621	0.8668	(40)
HLP (average)												0.8598	(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	2.3728	(42)
Average daily hot water use (litres/day)	90.5539	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.6093	95.9872	92.3650	88.7428	85.1207	81.4985	81.4985	85.1207	88.7428	92.3650	95.9872	99.6093	(44)
Energy conte	147.7177	129.1949	133.3175	116.2295	111.5249	96.2375	89.1782	102.3333	103.5555	120.6840	131.7360	143.0567	(45)
Energy content (annual)										Total = Sum(45)m =		1424.7658	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Heat gains from water heating, kWh/month
                31.3900    27.4539    28.3300    24.6988    23.6990    20.4505    18.9504    21.7458    22.0055    25.6453    27.9939    30.3996 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m          118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398   118.6398 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                20.7799    18.4565    15.0098    11.3634     8.4943     7.1712     7.7488    10.0721    13.5188    17.1652    20.0344    21.3574 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               209.8678   212.0456   206.5577   194.8746   180.1267   166.2659   157.0059   154.8282   160.3161   171.9992   186.7470   200.6079 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640    34.8640 (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)
               -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119   -94.9119 (71)
Water heating gains (Table 5)
                42.1909    40.8540    38.0779    34.3038    31.8536    28.4034    25.4709    29.2283    30.5633    34.4695    38.8804    40.8596 (72)
Total internal gains
               331.4306   329.9481   318.2374   299.1338   279.0665   260.4325   248.8176   252.7205   262.9901   282.2259   304.2538   321.4169 (73)


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6. Solar gains
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[Jan]                                      Area        Solar flux              g                FF           Access            Gains
                                            m2          Table 6a     Specific data     Specific data          factor              W
                                                          W/m2       or Table 6b       or Table 6c         Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
East                                     9.0400          19.6403          0.6300            0.7000           0.7700          54.2610 (76)
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Solar gains     54.2610   106.1460   174.8073   254.9460   312.4459   319.8440   304.5045   261.5649   203.3081   125.9511    67.6571    44.6216 (83)
Total gains    385.6915   436.0941   493.0447   554.0798   591.5125   580.2765   553.3221   514.2854   466.2982   408.1771   371.9108   366.0385 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            79.1967    79.4315    79.6630    80.7686    80.9788    81.9722    81.9722    82.1589    81.5867    80.9788    80.5546    80.1158
alpha           6.2798     6.2954     6.3109     6.3846     6.3986     6.4648     6.4648     6.4773     6.4391     6.3986     6.3703     6.3411
util living area
                0.9991     0.9978     0.9925     0.9657     0.8726     0.6822     0.5057     0.5645     0.8431     0.9836     0.9980     0.9994 (86)

MIT            20.0569    20.1778    20.3904    20.6708    20.8867    20.9820    20.9977    20.9955    20.9336    20.6425    20.2993    20.0375 (87)
Th 2           20.1872    20.1894    20.1916    20.2018    20.2037    20.2126    20.2126    20.2143    20.2092    20.2037    20.1999    20.1958 (88)
util rest of house
                0.9988     0.9971     0.9898     0.9535     0.8322     0.6081     0.4170     0.4716     0.7813     0.9757     0.9971     0.9992 (89)
MIT 2          19.3144    19.4369    19.6500    19.9317    20.1267    20.2043    20.2120    20.2130    20.1718    19.9097    19.5671    19.3023 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.3548 (91)
MIT            19.5778    19.6997    19.9127    20.1939    20.3964    20.4802    20.4907    20.4906    20.4420    20.1697    19.8269    19.5631 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT   19.5778    19.6997    19.9127    20.1939    20.3964    20.4802    20.4907    20.4906    20.4420    20.1697    19.8269    19.5631 (93)


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8. Space heating requirement
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                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9986     0.9965     0.9887     0.9533     0.8429     0.6341     0.4486     0.5047     0.8012     0.9753     0.9966     0.9990 (94)
Useful gains   385.1325   434.5887   487.4675   528.2195   498.5565   367.9311   248.2029   259.5777   373.5914   398.1027   370.6632   365.6554 (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
              1011.9736   977.4068   883.2273   733.5299   563.3523   376.3055   248.9893   261.1840   407.7785   619.9295   828.7939  1005.9483 (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
               466.3698   364.7737   294.4454   147.8235    48.2081     0.0000     0.0000     0.0000     0.0000   165.0391   329.8540   476.3779 (98)
Space heating                                                                                                                    2292.8916 (98)
Space heating per m2                                                                                                (98) / (4) =    30.3533 (99)


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8c. Space cooling requirement
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Calculated for June, July and August. See Table 10b
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Ext. temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000
Heat loss rate W
                0.0000     0.0000     0.0000     0.0000     0.0000   601.5554   473.5649   485.2590     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation     0.0000     0.0000     0.0000     0.0000     0.0000     0.9465     0.9783     0.9674     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss     0.0000     0.0000     0.0000     0.0000     0.0000   569.3966   463.2998   469.4214     0.0000     0.0000     0.0000     0.0000 (102)
Total gains     0.0000     0.0000     0.0000     0.0000     0.0000   767.3987   734.1600   690.2861     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   142.5615   201.5199   164.3234     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                    508.4048 (104)
Cooled fraction                                                                                        fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	35.6404	50.3800	41.0808	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												127.1012	(107)
Space cooling per m2												1.6826	(108)
Energy for space heating												30.3533	(99)
Energy for space cooling												1.6826	(108)
Total												32.0359	(109)
Target Fabric Energy Efficiency (TFEE)												36.8	(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	75.5400 (1b)	x	2.4000 (2b)	=	181.2960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		181.2960	(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		3.2200	
Infiltration rate		0.1610	(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) =	0.1248	(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	0.1310	0.1248	0.1248	0.1154	0.1154	0.1029	0.1061	0.0998	0.1029	0.1092	0.1092	0.1185	(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)			9.0400	1.2357	11.1711			(27)
WT-E-01	32.6600	9.0400	23.6200	0.2000	4.7240			(29a)
WT-I-01	40.3000	2.1200	38.1800	0.2890	11.0337			(29a)
Total net area of external elements Aum(A, m2)			72.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0488			(33)
Party Wall 1			15.1200	0.0000	0.0000			(32)
Party Floor 1			75.5400					(32d)
Party Ceilings 1			75.5400					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0492	(36)
Total fabric heat loss (33) + (36) =	36.0980	(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	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	(38)
Heat transfer coeff	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	(39)
Average = Sum(39)m / 12 =												66.0118	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	(40)
HLP (average)												0.8739	(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	2.3728	(42)
Average daily hot water use (litres/day)	90.5539	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.6093	95.9872	92.3650	88.7428	85.1207	81.4985	81.4985	85.1207	88.7428	92.3650	95.9872	99.6093	(44)
Energy conte	147.7177	129.1949	133.3175	116.2295	111.5249	96.2375	89.1782	102.3333	103.5555	120.6840	131.7360	143.0567	(45)
Energy content (annual)										Total = Sum(45)m =		1424.7658	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1577	19.3792	19.9976	17.4344	16.7287	14.4356	13.3767	15.3500	15.5333	18.1026	19.7604	21.4585	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     14.1097   12.7229   14.0521   13.5603   13.9844   13.5010   13.9310   13.9656   13.5334   14.0241   13.6163   14.0986 (61)
Total heat required for water heating calculated for each month
              161.8274  141.9178  147.3696  129.7898  125.5093  109.7386  103.1092  116.2989  117.0889  134.7080  145.3522  157.1553 (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
              161.8274  141.9178  147.3696  129.7898  125.5093  109.7386  103.1092  116.2989  117.0889  134.7080  145.3522  157.1553 (64)
                                                                                       Total per year (kWh/year) = Sum(64)m =   1589.8651 (64)
RHI water heating demand                                                                                                          1590 (64)
Heat gains from water heating, kWh/month
                52.6436   46.1380   47.8411   42.0364   40.5781   35.3742   33.1345   37.5172   37.8155   43.6334   47.2063   51.0910 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                 Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         142.3678  142.3678  142.3678  142.3678  142.3678  142.3678  142.3678  142.3678  142.3678  142.3678  142.3678  142.3678 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                51.9497   46.1413   37.5246   28.4085   21.2357   17.9281   19.3719   25.1804   33.7970   42.9131   50.0859   53.3936 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               313.2356  316.4860  308.2951  290.8576  268.8459  248.1580  234.3372  231.0868  239.2777  256.7152  278.7269  299.4148 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                51.6096   51.6096   51.6096   51.6096   51.6096   51.6096   51.6096   51.6096   51.6096   51.6096   51.6096   51.6096 (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)
              -94.9119  -94.9119  -94.9119  -94.9119  -94.9119  -94.9119  -94.9119  -94.9119  -94.9119  -94.9119  -94.9119  -94.9119 (71)
Water heating gains (Table 5)
                70.7575   68.6578   64.3026   58.3839   54.5405   49.1309   44.5356   50.4264   52.5216   58.6471   65.5643   68.6707 (72)
Total internal gains
              538.0083  533.3505  512.1877  479.7155  446.6876  417.2825  400.3103  408.7591  427.6618  460.3409  496.4426  523.5446 (73)


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6. Solar gains
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[Jan]                                     Area        Solar flux              g              FF          Access            Gains
                                           m2          Table 6a     Specific data     Specific data      factor              W
                                                          W/m2       or Table 6b       or Table 6c     Table 6d
---------------------------------------------------------------------------------------------------------------------------------
East                                    9.0400           22.3313            0.4500            0.0000           0.7700          69.9497 (76)
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Solar gains     69.9497  123.0867  199.8710  299.5493  356.9257  390.7204  368.0744  323.8182  251.6920  155.8605   89.3522   56.9651 (83)
Total gains    607.9580  656.4372  712.0587  779.2648  803.6133  808.0029  768.3847  732.5773  679.3538  616.2014  585.7948  580.5097 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                              21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            79.4681   79.4681   79.4681   79.4681   79.4681   79.4681   79.4681   79.4681   79.4681   79.4681   79.4681   79.4681
alpha           6.2979    6.2979    6.2979    6.2979    6.2979    6.2979    6.2979    6.2979    6.2979    6.2979    6.2979    6.2979
util living area
                0.9862    0.9765    0.9411    0.8350    0.6404    0.4076    0.2663    0.2883    0.5568    0.8660    0.9695    0.9891 (86)

MIT            20.4109   20.5083   20.7020   20.8926   20.9823   20.9991   21.0000   20.9999   20.9940   20.8862   20.6200   20.3777 (87)
Th 2           20.1898   20.1898   20.1898   20.1898   20.1898   20.1898   20.1898   20.1898   20.1898   20.1898   20.1898   20.1898 (88)
util rest of house
                0.9821    0.9697    0.9247    0.7972    0.5816    0.3420    0.1967    0.2153    0.4822    0.8246    0.9591    0.9858 (89)
MIT 2          19.6674   19.7623   19.9465   20.1139   20.1803   20.1895   20.1898   20.1898   20.1874   20.1127   19.8719   19.6349 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.3548 (91)
MIT            19.9312   20.0269   20.2145   20.3902   20.4649   20.4767   20.4772   20.4772   20.4736   20.3871   20.1373   19.8984 (92)
Temperature adjustment                                                                                                         -0.1500
adjusted MIT   19.7812   19.8769   20.0645   20.2402   20.3149   20.3267   20.3272   20.3272   20.3236   20.2371   19.9873   19.7484 (93)


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8. Space heating requirement
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                 Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9796    0.9665    0.9218    0.7998    0.5909    0.3532    0.2085    0.2277    0.4947    0.8273    0.9560    0.9835 (94)
Useful gains  595.5265  634.4421  656.3685  623.2380  474.8803  285.3503  160.2175  166.8128  336.1033  509.7727  560.0293  570.9491 (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
              969.1324  942.4473  836.0081  682.5722  482.8679  285.6147  160.2241  166.8243  338.2172  570.1511  791.3051  966.9700 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              277.9628  206.9795  133.6519   42.7207    5.9428    0.0000    0.0000    0.0000    0.0000   44.9216  166.5186  294.6396 (98)
Space heating                                                                                                            1173.3374 (98)
RHI space heating demand                                                                                                      1173 (98)


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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	75.5400 (1b)	x	2.4000 (2b)	=	181.2960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.5400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.2960	(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		3.2200	
Infiltration rate		0.1610	(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) =	0.1248	(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	0.1591	0.1560	0.1528	0.1373	0.1341	0.1185	0.1185	0.1154	0.1248	0.1341	0.1404	0.1466	(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)			9.0400	1.2357	11.1711			(27)
WT-E-01	32.6600	9.0400	23.6200	0.2000	4.7240			(29a)
WT-I-01	40.3000	2.1200	38.1800	0.2890	11.0337			(29a)
Total net area of external elements Aum(A, m2)			72.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0488			(33)
Party Wall 1			15.1200	0.0000	0.0000			(32)
Party Floor 1			75.5400					(32d)
Party Ceilings 1			75.5400					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0492	(36)
Total fabric heat loss (33) + (36) =	36.0980	(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	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	(38)
Heat transfer coeff	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	(39)

Average = Sum(39)m / 12 = 66.0118 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	(40)
HLP (average)												0.8739	(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	2.3728	(42)
Average daily hot water use (litres/day)	90.5539	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.6093	95.9872	92.3650	88.7428	85.1207	81.4985	81.4985	85.1207	88.7428	92.3650	95.9872	99.6093	(44)
Energy conte	147.7177	129.1949	133.3175	116.2295	111.5249	96.2375	89.1782	102.3333	103.5555	120.6840	131.7360	143.0567	(45)
Energy content (annual)										Total = Sum(45)m =		1424.7658	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1577	19.3792	19.9976	17.4344	16.7287	14.4356	13.3767	15.3500	15.5333	18.1026	19.7604	21.4585	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1097	12.7229	14.0521	13.5603	13.9844	13.5010	13.9310	13.9656	13.5334	14.0241	13.6163	14.0986	(61)
Total heat required for water heating calculated for each month													
	161.8274	141.9178	147.3696	129.7898	125.5093	109.7386	103.1092	116.2989	117.0889	134.7080	145.3522	157.1553	(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													
	161.8274	141.9178	147.3696	129.7898	125.5093	109.7386	103.1092	116.2989	117.0889	134.7080	145.3522	157.1553	(64)
								Total per year (kWh/year) = Sum(64)m =				1589.8651	(64)
Heat gains from water heating, kWh/month													
	52.6436	46.1380	47.8411	42.0364	40.5781	35.3742	33.1345	37.5172	37.8155	43.6334	47.2063	51.0910	(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	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.9497	46.1413	37.5246	28.4085	21.2357	17.9281	19.3719	25.1804	33.7970	42.9131	50.0859	53.3936	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	313.2356	316.4860	308.2951	290.8576	268.8459	248.1580	234.3372	231.0868	239.2777	256.7152	278.7269	299.4148	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	(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)													
	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	(71)
Water heating gains (Table 5)													
	70.7575	68.6578	64.3026	58.3839	54.5405	49.1309	44.5356	50.4264	52.5216	58.6471	65.5643	68.6707	(72)
Total internal gains													
	538.0083	533.3505	512.1877	479.7155	446.6876	417.2825	400.3103	408.7591	427.6618	460.3409	496.4426	523.5446	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.0400	19.6403	0.4500	0.0000	0.7700	61.5204	(76)

Solar gains	61.5204	120.3469	198.1942	289.0544	354.2471	362.6349	345.2432	296.5588	230.5081	142.8017	76.7087	50.5914	(83)
Total gains	599.5287	653.6975	710.3820	768.7699	800.9347	779.9174	745.5535	705.3179	658.1699	603.1427	573.1513	574.1359	(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	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	
alpha	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	
util living area													
	0.9900	0.9814	0.9555	0.8789	0.7273	0.5364	0.3890	0.4293	0.6695	0.9121	0.9800	0.9923	(86)
MIT	20.3339	20.4486	20.6356	20.8389	20.9589	20.9946	20.9994	20.9989	20.9806	20.8214	20.5341	20.2940	(87)
Th 2	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	(88)
util rest of house													
	0.9871	0.9761	0.9432	0.8492	0.6758	0.4709	0.3177	0.3544	0.5998	0.8829	0.9733	0.9900	(89)
MIT 2	19.5914	19.7038	19.8839	20.0688	20.1647	20.1875	20.1896	20.1895	20.1803	20.0582	19.7889	19.5521	(90)
Living area fraction									fLA = Living area / (4) =			0.3548	(91)
MIT	19.8548	19.9680	20.1506	20.3420	20.4465	20.4738	20.4769	20.4766	20.4643	20.3290	20.0533	19.8153	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7048	19.8180	20.0006	20.1920	20.2965	20.3238	20.3269	20.3266	20.3143	20.1790	19.9033	19.6653	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9850	0.9732	0.9399	0.8493	0.6829	0.4818	0.3298	0.3671	0.6109	0.8825	0.9704	0.9882	(94)
Useful gains	590.5092	636.1743	667.6613	652.9172	546.9242	375.8006	245.8668	258.9037	402.0870	532.2674	556.1714	567.3375	(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													
	1016.8992	984.7674	891.1978	745.4062	567.4682	377.8403	246.0198	259.2037	410.2140	632.3261	845.1668	1020.8940	(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													
	317.2341	234.2546	166.3112	66.5921	15.2847	0.0000	0.0000	0.0000	0.0000	74.4437	208.0767	337.4461	(98)
Space heating												1419.6432	(98)
Space heating per m2											(98) / (4) =	18.7933	(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	1568.6665	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	317.2341	234.2546	166.3112	66.5921	15.2847	0.0000	0.0000	0.0000	0.0000	74.4437	208.0767	337.4461	(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)	350.5350	258.8449	183.7693	73.5824	16.8892	0.0000	0.0000	0.0000	0.0000	82.2583	229.9190	372.8686	(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	161.8274	141.9178	147.3696	129.7898	125.5093	109.7386	103.1092	116.2989	117.0889	134.7080	145.3522	157.1553	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.3931	89.2656	88.9679	88.3594	87.6364	87.3000	87.3000	87.3000	87.3000	88.4127	89.1560	89.4581	(217)
Fuel for water heating, kWh/month	181.0290	158.9838	165.6436	146.8884	143.2160	125.7028	118.1091	133.2176	134.1224	152.3628	163.0314	175.6748	(219)
Water heating fuel used												1797.9815	(219)

Annual totals kWh/year		
Space heating fuel - main system	1568.6665	(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)	40.6973	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	115.6973	(231)
Electricity for lighting (calculated in Appendix L)	366.9792	(232)
Total delivered energy for all uses	3849.3247	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1568.6665	3.4800	54.5896	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1797.9815	3.4800	62.5698	(247)
Mechanical ventilation fans	40.6973	13.1900	5.3680	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	366.9792	13.1900	48.4046	(250)
Additional standing charges			120.0000	(251)
Total energy cost			300.8244	(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] =	1.0482	(257)
SAP value		85.3780	
SAP rating (Section 12)		85	(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	1568.6665	0.2160	338.8320	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1797.9815	0.2160	388.3640	(264)
Space and water heating			727.1960	(265)
Pumps and fans	115.6973	0.5190	60.0469	(267)
Energy for lighting	366.9792	0.5190	190.4622	(268)
Total kg/year			977.7051	(272)
CO2 emissions per m2			12.9400	(273)
EI value			89.1312	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9050 = 3.845, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9050 = 0.2387, stars = 4
Water heating energy efficiency	3.48 / 0.8832 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8832 = 0.2446, 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	75.5400 (1b)	x	2.4000 (2b)	=	181.2960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		181.2960	(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		3.2200	
Infiltration rate		0.1610	(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) =	0.1248	(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	0.1310	0.1248	0.1248	0.1154	0.1154	0.1029	0.1061	0.0998	0.1029	0.1092	0.1092	0.1185	(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)			9.0400	1.2357	11.1711			(27)
WT-E-01	32.6600	9.0400	23.6200	0.2000	4.7240			(29a)
WT-I-01	40.3000	2.1200	38.1800	0.2890	11.0337			(29a)
Total net area of external elements Aum(A, m2)			72.9600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0488			(33)
Party Wall 1			15.1200	0.0000	0.0000			(32)
Party Floor 1			75.5400					(32d)
Party Ceilings 1			75.5400					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0492	(36)
Total fabric heat loss (33) + (36) =	36.0980	(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	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	29.9138	(38)
Heat transfer coeff	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	66.0118	(39)
Average = Sum(39)m / 12 =												66.0118	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	0.8739	(40)
HLP (average)												0.8739	(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	2.3728	(42)
Average daily hot water use (litres/day)	90.5539	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.6093	95.9872	92.3650	88.7428	85.1207	81.4985	81.4985	85.1207	88.7428	92.3650	95.9872	99.6093	(44)
Energy conte	147.7177	129.1949	133.3175	116.2295	111.5249	96.2375	89.1782	102.3333	103.5555	120.6840	131.7360	143.0567	(45)
Energy content (annual)										Total = Sum(45)m =		1424.7658	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1577	19.3792	19.9976	17.4344	16.7287	14.4356	13.3767	15.3500	15.5333	18.1026	19.7604	21.4585	(46)

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

Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1097	12.7229	14.0521	13.5603	13.9844	13.5010	13.9310	13.9656	13.5334	14.0241	13.6163	14.0986	(61)
Total heat required for water heating calculated for each month													
	161.8274	141.9178	147.3696	129.7898	125.5093	109.7386	103.1092	116.2989	117.0889	134.7080	145.3522	157.1553	(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													
	161.8274	141.9178	147.3696	129.7898	125.5093	109.7386	103.1092	116.2989	117.0889	134.7080	145.3522	157.1553	(64)
								Total per year (kWh/year) = Sum(64)m =				1589.8651	(64)
Heat gains from water heating, kWh/month													
	52.6436	46.1380	47.8411	42.0364	40.5781	35.3742	33.1345	37.5172	37.8155	43.6334	47.2063	51.0910	(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	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	142.3678	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.9497	46.1413	37.5246	28.4085	21.2357	17.9281	19.3719	25.1804	33.7970	42.9131	50.0859	53.3936	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	313.2356	316.4860	308.2951	290.8576	268.8459	248.1580	234.3372	231.0868	239.2777	256.7152	278.7269	299.4148	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	51.6096	(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)													
	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	-94.9119	(71)
Water heating gains (Table 5)													
	70.7575	68.6578	64.3026	58.3839	54.5405	49.1309	44.5356	50.4264	52.5216	58.6471	65.5643	68.6707	(72)
Total internal gains													
	538.0083	533.3505	512.1877	479.7155	446.6876	417.2825	400.3103	408.7591	427.6618	460.3409	496.4426	523.5446	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.0400	22.3313	0.4500	0.0000	0.7700	69.9497	(76)

Solar gains	69.9497	123.0867	199.8710	299.5493	356.9257	390.7204	368.0744	323.8182	251.6920	155.8605	89.3522	56.9651	(83)
Total gains	607.9580	656.4372	712.0587	779.2648	803.6133	808.0029	768.3847	732.5773	679.3538	616.2014	585.7948	580.5097	(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	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	79.4681	
alpha	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	6.2979	
util living area													
	0.9862	0.9765	0.9411	0.8350	0.6404	0.4076	0.2663	0.2883	0.5568	0.8660	0.9695	0.9891	(86)
MIT	20.4109	20.5083	20.7020	20.8926	20.9823	20.9991	21.0000	20.9999	20.9940	20.8862	20.6200	20.3777	(87)
Th 2	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	20.1898	(88)
util rest of house													
	0.9821	0.9697	0.9247	0.7972	0.5816	0.3420	0.1967	0.2153	0.4822	0.8246	0.9591	0.9858	(89)
MIT 2	19.6674	19.7623	19.9465	20.1139	20.1803	20.1895	20.1898	20.1898	20.1874	20.1127	19.8719	19.6349	(90)
Living area fraction									fLA = Living area / (4) =			0.3548	(91)
MIT	19.9312	20.0269	20.2145	20.3902	20.4649	20.4767	20.4772	20.4772	20.4736	20.3871	20.1373	19.8984	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.7812	19.8769	20.0645	20.2402	20.3149	20.3267	20.3272	20.3272	20.3236	20.2371	19.9873	19.7484	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9796	0.9665	0.9218	0.7998	0.5909	0.3532	0.2085	0.2277	0.4947	0.8273	0.9560	0.9835	(94)
Useful gains	595.5265	634.4421	656.3685	623.2380	474.8803	285.3503	160.2175	166.8128	336.1033	509.7727	560.0293	570.9491	(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													
	969.1324	942.4473	836.0081	682.5722	482.8679	285.6147	160.2241	166.8243	338.2172	570.1511	791.3051	966.9700	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	277.9628	206.9795	133.6519	42.7207	5.9428	0.0000	0.0000	0.0000	0.0000	44.9216	166.5186	294.6396	(98)
Space heating												1173.3374	(98)
Space heating per m2											(98) / (4) =	15.5327	(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	1296.5054	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	277.9628	206.9795	133.6519	42.7207	5.9428	0.0000	0.0000	0.0000	0.0000	44.9216	166.5186	294.6396	(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)	307.1413	228.7066	147.6816	47.2052	6.5666	0.0000	0.0000	0.0000	0.0000	49.6371	183.9984	325.5686	(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

	161.8274	141.9178	147.3696	129.7898	125.5093	109.7386	103.1092	116.2989	117.0889	134.7080	145.3522	157.1553	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.2956	89.1705	88.7932	88.0712	87.4398	87.3000	87.3000	87.3000	87.3000	88.0788	88.9799	89.3606	(217)
Fuel for water heating, kWh/month	181.2267	159.1533	165.9695	147.3692	143.5380	125.7028	118.1091	133.2176	134.1224	152.9403	163.3540	175.8664	(219)

Water heating fuel used	1800.5693	(219)
Annual totals kWh/year		
Space heating fuel - main system	1296.5054	(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)	40.6973	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	115.6973	(231)
Electricity for lighting (calculated in Appendix L)	366.9792	(232)
Total delivered energy for all uses	3579.7513	(238)

10a. Fuel costs - using BEDF prices (485)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1296.5054	3.7400	48.4893	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1800.5693	3.7400	67.3413	(247)
Mechanical ventilation fans	40.6973	19.1200	7.7813	(249)
Pumps and fans for heating	75.0000	19.1200	14.3400	(249)
Energy for lighting	366.9792	19.1200	70.1664	(250)
Additional standing charges			94.0000	(251)
Total energy cost			302.1184	(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	1296.5054	0.2160	280.0452	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.5693	0.2160	388.9230	(264)
Space and water heating			668.9681	(265)
Pumps and fans	115.6973	0.5190	60.0469	(267)
Energy for lighting	366.9792	0.5190	190.4622	(268)
Total kg/year			919.4773	(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	1296.5054	1.2200	1581.7366	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.5693	1.2200	2196.6945	(264)
Space and water heating			3778.4311	(265)
Pumps and fans	115.6973	3.0700	355.1908	(267)
Energy for lighting	366.9792	3.0700	1126.6263	(268)
Primary energy kWh/year			5260.2482	(272)
Primary energy kWh/m2/year			69.6353	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 85
Current environmental impact rating:	B 89

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

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 485 TEST (29 Oct 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	£92	£92	£0
Mains gas	£210	£210	£0
Space heating	£165	£165	£0
Water heating	£67	£67	£0
Lighting	£70	£70	£0
Total cost of fuels	£302	£302	£0
Total cost of uses	£302	£302	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	70 kWh/m²	70 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	West
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	358.97	(P1)
Transmission heat loss coefficient	36.10	(37)
Summer heat loss coefficient	395.06	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	9.0400	117.5071	0.4500	0.0000	0.9000	430.2169
total:						430.2169

	Jun	Jul	Aug	
Solar gains	457	430	378	(P4)
Internal gains	414	397	406	
Total summer gains	871	828	784	(P5)
Summer gain/loss ratio	2.20	2.09	1.99	(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	18.45	20.24	20.04	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant