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

Property Reference	SECPMW025h_054_As_Built	**Issued on Date**	24/01/2022
Assessment Reference	001	**Prop Type Ref**	MFF
Property			

SAP Rating	85 B	**DER**	15.14	**TER**	16.55
Environmental	90 B	**% DER<TER**	8.52		
CO_2 Emissions (t/year)	0.73	**DFEE**	30.92	**TFEE**	33.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.81		

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 58 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) 16.55 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.14 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (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: 4.01 (measured in this dwelling)
Maximum 10.0 OK

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

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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

Hot water controls: No cylinder

Boiler interlock Yes OK

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

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

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9 Summertime temperature
Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 7.86 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

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	58.2200 (1b)	x	2.4000 (2b)	=	139.7280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		139.7280	(5)

2. Ventilation rate

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =		0.0000	(8)
Pressure test			Yes	
Measured/design AP50			4.0100	
Infiltration rate			0.2005	(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) =		0.1554	(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	0.1981	0.1942	0.1903	0.1709	0.1670	0.1476	0.1476	0.1437	0.1554	0.1670	0.1748	0.1826	(22b)

Mechanical extract ventilation - decentralised

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.30)			7.8600	1.2357	9.7129			(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380			(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861			(29a)
Total net area of external elements Aum(A, m2)			60.1900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.0570			(33)
Party Wall 1			14.8800	0.0000	0.0000			(32)
Party Floor 1			58.2200					(32d)
Party Ceilings 1			58.2200					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8433	(36)
Total fabric heat loss					(33) + (36) =		29.9003	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	(38)
Heat transfer coeff	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	(39)
Average = Sum(39)m / 12 =												52.9554	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	(40)
HLP (average)												0.9096	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9309	(42)
Average daily hot water use (litres/day)	80.0585	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.0644	84.8620	81.6597	78.4574	75.2550	72.0527	72.0527	75.2550	78.4574	81.6597	84.8620	88.0644	(44)
Energy conte	130.5969	114.2209	117.8657	102.7582	98.5989	85.0834	78.8423	90.4727	91.5532	106.6964	116.4675	126.4761	(45)
Energy content (annual)										Total = Sum(45)m =		1259.6323	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5895	17.1331	17.6799	15.4137	14.7898	12.7625	11.8263	13.5709	13.7330	16.0045	17.4701	18.9714	(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     14.0326    12.6579    13.9876    13.5063    13.9346    13.4599    13.8929    13.9200    13.4852    13.9657    13.5500    14.0239 (61)
Total heat required for water heating calculated for each month
              144.6295   126.8788   131.8533   116.2645   112.5336    98.5433    92.7352   104.3926   105.0384   120.6621   130.0175   140.5000 (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
              144.6295   126.8788   131.8533   116.2645   112.5336    98.5433    92.7352   104.3926   105.0384   120.6621   130.0175   140.5000 (64)
                                                                                                 Total per year (kWh/year) = Sum(64)m =   1424.0488 (64)
Heat gains from water heating, kWh/month
               46.9316    41.1429    42.6872    37.5437    36.2678    31.6552    29.6883    33.5622    33.8127    38.9680    42.1129    45.5593 (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          96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               16.2383    14.4227    11.7293     8.8798     6.6378     5.6039     6.0552     7.8708    10.5642    13.4136    15.6557    16.6896 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              168.4365   170.1843   165.7798   156.4031   144.5667   133.4422   126.0104   124.2625   128.6670   138.0437   149.8801   161.0046 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544 (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)
             -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354 (71)
Water heating gains (Table 5)
               63.0801    61.2246    57.3753    52.1440    48.7471    43.9656    39.9036    45.1104    46.9621    52.3763    58.4902    61.2356 (72)
Total internal gains
              302.7181   300.7948   289.8477   272.3902   254.9149   237.9750   226.9324   232.2070   241.1566   258.7969   278.9892   293.8930 (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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Southeast                                 7.8600         36.7938          0.4500            0.0000          0.7700         100.2076 (77)
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Solar gains   100.2076   170.6907   233.5464   289.3753   324.1245   321.7806   310.2308   284.3064   252.8814   188.6496   120.0257    85.7569 (83)
Total gains   402.9258   471.4855   523.3941   561.7656   579.0394   559.7556   537.1633   516.5134   494.0380   447.4465   399.0149   379.6499 (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            76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483
alpha           6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899
util living area
                0.9954     0.9877     0.9670     0.9088     0.7810     0.5939     0.4322     0.4690     0.7048     0.9313     0.9889     0.9968 (86)

MIT            20.1847    20.3473    20.5584    20.7803    20.9321    20.9891    20.9986    20.9978    20.9710    20.7739    20.4239    20.1376 (87)
Th 2           20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594 (88)
util rest of house
                0.9940     0.9840     0.9571     0.8832     0.7299     0.5209     0.3505     0.3847     0.6322     0.9061     0.9848     0.9958 (89)
MIT 2          19.4182    19.5788    19.7842    19.9905    20.1166    20.1546    20.1590    20.1587    20.1450    19.9893    19.6556    19.3714 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.4483 (91)
MIT            19.7619    19.9233    20.1313    20.3446    20.4822    20.5287    20.5354    20.5349    20.5153    20.3411    20.0000    19.7149 (92)
Temperature adjustment                                                                                                           -0.1500
adjusted MIT   19.6119    19.7733    19.9813    20.1946    20.3322    20.3787    20.3854    20.3849    20.3653    20.1911    19.8500    19.5649 (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     0.9928     0.9819     0.9547     0.8844     0.7410     0.5403     0.3726     0.4075     0.6508     0.9072     0.9830     0.9948 (94)
Useful gains  400.0394   462.9453   499.6765   496.8245   429.0637   302.4567   200.1472   210.4843   321.5270   405.9223   392.2202   377.6897 (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
             810.8460   787.6237   713.9080   598.1090   457.1219   306.0135   200.4581   211.0208   331.7816   507.8985   675.1835   813.6532 (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
             305.6401   218.1839   159.3883    72.9248    20.8753     0.0000     0.0000     0.0000     0.0000    75.8703   203.7336   324.3569 (98)
Space heating                                                                                                                  1380.9731 (98)
Space heating per m2                                                                                          (98) / (4) =     23.7199 (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	1525.9371	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	305.6401	218.1839	159.3883	72.9248	20.8753	0.0000	0.0000	0.0000	0.0000	75.8703	203.7336	324.3569	(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)	337.7238	241.0872	176.1196	80.5799	23.0666	0.0000	0.0000	0.0000	0.0000	83.8346	225.1200	358.4054	(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	144.6295	126.8788	131.8533	116.2645	112.5336	98.5433	92.7352	104.3926	105.0384	120.6621	130.0175	140.5000	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.4469	89.2965	89.0227	88.5063	87.7857	87.3000	87.3000	87.3000	87.3000	88.5082	89.2259	89.5084	(217)
Fuel for water heating, kWh/month	161.6932	142.0872	148.1120	131.3630	128.1912	112.8790	106.2259	119.5792	120.3189	136.3288	145.7172	156.9686	(219)

Water heating fuel used	1609.4641	(219)
Annual totals kWh/year		
Space heating fuel - main system	1525.9371	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	31.3661	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	106.3661	(231)
Electricity for lighting (calculated in Appendix L)	286.7727	(232)
Total delivered energy for all uses	3528.5400	(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	1525.9371	0.2160	329.6024	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1609.4641	0.2160	347.6442	(264)
Space and water heating			677.2467	(265)
Pumps and fans	106.3661	0.5190	55.2040	(267)
Energy for lighting	286.7727	0.5190	148.8350	(268)
Total CO2, kg/year			881.2857	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1400	(273)

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

DER		15.1400	ZC1
Total Floor Area	TFA	58.2200	
Assumed number of occupants	N	1.9309	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1439	ZC2
CO2 emissions from cooking, equation (L16)		2.8399	ZC3
Total CO2 emissions		35.1239	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		35.1239	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	58.2200 (1b)	x	2.4000 (2b)	=	139.7280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	139.7280	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1431	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3931	(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) =	0.3047	(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	0.3885	0.3808	0.3732	0.3351	0.3275	0.2894	0.2894	0.2818	0.3047	0.3275	0.3428	0.3580	(22b)
Effective ac	0.5755	0.5725	0.5697	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5587	0.5641	(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)			7.8600	1.3258	10.4205			(27)
WT-E-01	33.5500	7.8600	25.6900	0.1800	4.6242			(29a)
WT-I-01	26.6400	2.1200	24.5200	0.1800	4.4136			(29a)
Total net area of external elements Aum(A, m2)			60.1900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.5783			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0637	(36)
Total fabric heat loss					(33) + (36) =		26.6420	(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	26.5343	26.3992	26.2668	25.6448	25.5284	24.9867	24.9867	24.8863	25.1953	25.5284	25.7638	26.0099	(38)
Heat transfer coeff	53.1762	53.0411	52.9087	52.2867	52.1703	51.6286	51.6286	51.5283	51.8373	52.1703	52.4058	52.6519	(39)
Average = Sum(39)m / 12 =												52.2862	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9134	0.9110	0.9088	0.8981	0.8961	0.8868	0.8868	0.8851	0.8904	0.8961	0.9001	0.9044	(40)
HLP (average)												0.8981	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9309	(42)
Average daily hot water use (litres/day)	80.0585	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.0644	84.8620	81.6597	78.4574	75.2550	72.0527	72.0527	75.2550	78.4574	81.6597	84.8620	88.0644	(44)
Energy conte	130.5969	114.2209	117.8657	102.7582	98.5989	85.0834	78.8423	90.4727	91.5532	106.6964	116.4675	126.4761	(45)
Energy content (annual)										Total = Sum(45)m =		1259.6323	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5895	17.1331	17.6799	15.4137	14.7898	12.7625	11.8263	13.5709	13.7330	16.0045	17.4701	18.9714	(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	44.8766	39.0598	41.6129	38.6913	38.3491	35.5328	36.7173	38.3491	38.6913	41.6129	41.8498	44.8766	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month													
	175.4736	153.2807	159.4786	141.4495	136.9481	120.6162	115.5595	128.8218	130.2445	148.3093	158.3173	171.3528	(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													
	175.4736	153.2807	159.4786	141.4495	136.9481	120.6162	115.5595	128.8218	130.2445	148.3093	158.3173	171.3528	(64)
								Total per year (kWh/year) = Sum(64)m =				1739.8518	(64)
Heat gains from water heating, kWh/month													
	54.6426	47.7434	49.5936	43.8399	42.3714	37.1734	35.3944	39.6694	40.1143	45.8798	49.1879	53.2725	(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	96.5443	96.5443	96.5443	96.5443	96.5443	96.5443	96.5443	96.5443	96.5443	96.5443	96.5443	96.5443	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2383	14.4227	11.7293	8.8798	6.6378	5.6039	6.0552	7.8708	10.5642	13.4136	15.6557	16.6896	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	168.4365	170.1843	165.7798	156.4031	144.5667	133.4422	126.0104	124.2625	128.6670	138.0437	149.8801	161.0046	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6544	32.6544	32.6544	32.6544	32.6544	32.6544	32.6544	32.6544	32.6544	32.6544	32.6544	32.6544	(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)													
	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	(71)
Water heating gains (Table 5)													
	73.4444	71.0467	66.6580	60.8888	56.9508	51.6298	47.5731	53.3191	55.7143	61.6664	68.3165	71.6028	(72)
Total internal gains													
	313.0824	310.6170	299.1304	281.1350	263.1187	245.6392	234.6019	240.4157	249.9087	268.0870	288.8155	304.2602	(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	
Southeast	7.8600	36.7938	0.6300	0.7000	0.7700	88.3831	(77)

Solar gains	88.3831	150.5492	205.9879	255.2291	285.8778	283.8105	273.6236	250.7583	223.0414	166.3889	105.8626	75.6375	(83)
Total gains	401.4655	461.1662	505.1184	536.3641	548.9965	529.4497	508.2255	491.1740	472.9501	434.4759	394.6782	379.8978	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	76.0312	76.2249	76.4157	77.3247	77.4972	78.3104	78.3104	78.4628	77.9951	77.4972	77.1491	76.7884	
alpha	6.0687	6.0817	6.0944	6.1550	6.1665	6.2207	6.2207	6.2309	6.1997	6.1665	6.1433	6.1192	
util living area													
	0.9956	0.9890	0.9718	0.9205	0.8022	0.6112	0.4453	0.4799	0.7186	0.9364	0.9892	0.9968	(86)
MIT	20.1767	20.3290	20.5338	20.7651	20.9242	20.9884	20.9986	20.9978	20.9698	20.7705	20.4288	20.1457	(87)
Th 2	20.1562	20.1581	20.1601	20.1691	20.1708	20.1787	20.1787	20.1802	20.1757	20.1708	20.1674	20.1638	(88)
util rest of house													
	0.9942	0.9857	0.9632	0.8973	0.7527	0.5383	0.3631	0.3958	0.6470	0.9127	0.9854	0.9957	(89)
MIT 2	19.0598	19.2818	19.5763	19.9018	20.0998	20.1713	20.1782	20.1793	20.1535	19.9163	19.4349	19.0205	(90)
Living area fraction									fLA = Living area / (4) =			0.4483	(91)
MIT	19.5605	19.7513	20.0055	20.2888	20.4694	20.5376	20.5460	20.5462	20.5195	20.2992	19.8805	19.5249	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5605	19.7513	20.0055	20.2888	20.4694	20.5376	20.5460	20.5462	20.5195	20.2992	19.8805	19.5249	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9929	0.9837	0.9613	0.9010	0.7715	0.5707	0.4000	0.4336	0.6780	0.9169	0.9837	0.9947	(94)
Useful gains	398.6122	453.6282	485.5716	483.2487	423.5310	302.1548	203.3109	212.9712	320.6484	398.3675	388.2388	377.8867	(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													
	811.4961	787.7283	714.5612	595.4830	457.5017	306.5496	203.7254	213.6475	332.7685	506.0107	669.7701	806.8873	(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													
	307.1856	224.5153	170.3682	80.8087	25.2742	0.0000	0.0000	0.0000	0.0000	80.0866	202.7025	319.1765	(98)
Space heating												1410.1176	(98)
Space heating per m2											(98) / (4) =	24.2205	(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	1509.7619	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	307.1856	224.5153	170.3682	80.8087	25.2742	0.0000	0.0000	0.0000	0.0000	80.0866	202.7025	319.1765	(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)	328.8925	240.3804	182.4071	86.5189	27.0602	0.0000	0.0000	0.0000	0.0000	85.7458	217.0262	341.7307	(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	175.4736	153.2807	159.4786	141.4495	136.9481	120.6162	115.5595	128.8218	130.2445	148.3093	158.3173	171.3528	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.4470	86.0108	85.2177	83.7000	81.7225	80.3000	80.3000	80.3000	80.3000	83.5741	85.6744	86.5952	(217)
Fuel for water heating, kWh/month	202.9840	178.2110	187.1427	168.9958	167.5769	150.2070	143.9097	160.4256	162.1974	177.4584	184.7894	197.8778	(219)
Water heating fuel used												2081.7758	(219)

Annual totals kWh/year		
Space heating fuel - main system	1509.7619	(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)	286.7727	(232)
Total delivered energy for all uses	3953.3104	(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	1509.7619	0.2160	326.1086	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2081.7758	0.2160	449.6636	(264)
Space and water heating			775.7721	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.7727	0.5190	148.8350	(268)
Total CO2, kg/m2/year			963.5322	(272)
Emissions per m2 for space and water heating			13.3248	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5564	(272b)
Emissions per m2 for pumps and fans			0.6686	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.3248 * 1.00) + 2.5564 + 0.6686, rounded to 2 d.p.			16.5500	(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	58.2200 (1b)	x	2.4000 (2b)	=	139.7280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	139.7280	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1431	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.3436	(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) =	0.2663	(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	0.3396	0.3329	0.3262	0.2929	0.2863	0.2530	0.2530	0.2463	0.2663	0.2863	0.2996	0.3129	(22b)
Effective ac	0.5576	0.5554	0.5532	0.5429	0.5410	0.5320	0.5320	0.5303	0.5355	0.5410	0.5449	0.5490	(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)			7.8600	1.2357	9.7129			(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380			(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861			(29a)
Total net area of external elements Aum(A, m2)			60.1900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.0570			(33)
Party Wall 1			14.8800	0.0000	0.0000			(32)
Party Floor 1			58.2200					(32d)
Party Ceilings 1			58.2200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8433	(36)
Total fabric heat loss (33) + (36) =	29.9003	(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	25.7133	25.6101	25.5089	25.0337	24.9448	24.5309	24.5309	24.4542	24.6903	24.9448	25.1246	25.3127	(38)
Heat transfer coeff	55.6136	55.5104	55.4092	54.9340	54.8451	54.4312	54.4312	54.3545	54.5906	54.8451	55.0250	55.2130	(39)
Average = Sum(39)m / 12 =												54.9336	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9552	0.9535	0.9517	0.9436	0.9420	0.9349	0.9349	0.9336	0.9377	0.9420	0.9451	0.9484	(40)
HLP (average)												0.9436	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9309	(42)
Average daily hot water use (litres/day)	80.0585	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.0644	84.8620	81.6597	78.4574	75.2550	72.0527	72.0527	75.2550	78.4574	81.6597	84.8620	88.0644	(44)
Energy conte	130.5969	114.2209	117.8657	102.7582	98.5989	85.0834	78.8423	90.4727	91.5532	106.6964	116.4675	126.4761	(45)
Energy content (annual)										Total = Sum(45)m =		1259.6323	(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

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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
                27.7518   24.2719   25.0465   21.8361   20.9523   18.0802   16.7540   19.2254   19.4551   22.6730   24.7493   26.8762 (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           96.5443   96.5443   96.5443   96.5443   96.5443   96.5443   96.5443   96.5443   96.5443   96.5443   96.5443   96.5443 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                16.2383   14.4227   11.7293    8.8798    6.6378    5.6039    6.0552    7.8708   10.5642   13.4136   15.6557   16.6896 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               168.4365  170.1843  165.7798  156.4031  144.5667  133.4422  126.0104  124.2625  128.6670  138.0437  149.8801  161.0046 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                32.6544   32.6544   32.6544   32.6544   32.6544   32.6544   32.6544   32.6544   32.6544   32.6544   32.6544   32.6544 (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)
               -77.2354  -77.2354  -77.2354  -77.2354  -77.2354  -77.2354  -77.2354  -77.2354  -77.2354  -77.2354  -77.2354  -77.2354 (71)
Water heating gains (Table 5)
                37.3009   36.1190   33.6646   30.3279   28.1617   25.1114   22.5188   25.8406   27.0209   30.4744   34.3741   36.1239 (72)
Total internal gains
               273.9389  272.6892  263.1370  247.5742  231.3295  216.1208  206.5476  209.9372  218.2154  233.8951  251.8731  265.7813 (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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Southeast                                 7.8600          36.7938          0.4500            0.0000          0.7700         100.2076 (77)
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Solar gains    100.2076  170.6907  233.5464  289.3753  324.1245  321.7806  310.2308  284.3064  252.8814  188.6496  120.0257   85.7569 (83)
Total gains    374.1465  443.3799  496.6834  536.9495  555.4540  537.9014  516.7785  494.2436  471.0968  422.5446  371.8988  351.5382 (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             72.6990   72.8342   72.9672   73.5984   73.7177   74.2783   74.2783   74.3830   74.0614   73.7177   73.4768   73.2265
alpha            5.8466    5.8556    5.8645    5.9066    5.9145    5.9519    5.9519    5.9589    5.9374    5.9145    5.8985    5.8818
util living area
                 0.9971    0.9916    0.9764    0.9293    0.8165    0.6296    0.4609    0.5015    0.7457    0.9497    0.9926    0.9979 (86)

MIT             20.0706   20.2404   20.4670   20.7223   20.9052   20.9837   20.9978   20.9964   20.9574   20.7165   20.3370   20.0341 (87)
Th 2            20.1208   20.1223   20.1238   20.1306   20.1319   20.1379   20.1379   20.1390   20.1356   20.1319   20.1293   20.1266 (88)
util rest of house
                 0.9961    0.9890    0.9689    0.9074    0.7669    0.5524    0.3720    0.4100    0.6719    0.9293    0.9899    0.9973 (89)
MIT 2           19.2726   19.4422   19.6658   19.9132   20.0708   20.1307   20.1373   20.1380   20.1139   19.9138   19.5448   19.2411 (90)
Living area fraction                                                                        fLA = Living area / (4) =          0.4483 (91)
MIT             19.6304   19.8000   20.0250   20.2759   20.4449   20.5131   20.5231   20.5228   20.4920   20.2737   19.9000   19.5966 (92)
Temperature adjustment                                                                                                       0.0000
adjusted MIT    19.6304   19.8000   20.0250   20.2759   20.4449   20.5131   20.5231   20.5228   20.4920   20.2737   19.9000   19.5966 (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      0.9954    0.9878    0.9679    0.9115    0.7859    0.5867    0.4119    0.4512    0.7038    0.9332    0.9890    0.9967 (94)
Useful gains   372.4389  437.9635  480.7254  489.4390  436.5122  315.5992  212.8854  222.9905  331.5512  394.3108  367.7893  350.3911 (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
               852.5765  827.1063  749.4078  624.9254  479.6129  321.8566  213.5376  224.0944  348.9454  530.5526  704.3168  850.0930 (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
               357.2224  261.5040  199.8997   97.5502   32.0669    0.0000    0.0000    0.0000    0.0000  101.3639  242.2997  371.7782 (98)
Space heating                                                                                                             1663.6851 (98)
Space heating per m2                                                                                        (98) / (4) =     28.5758 (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  511.6531  402.7908  413.0945    0.0000    0.0000    0.0000    0.0000 (100)
Utilisation      0.0000    0.0000    0.0000    0.0000    0.0000    0.9535    0.9809    0.9745    0.0000    0.0000    0.0000    0.0000 (101)
Useful loss      0.0000    0.0000    0.0000    0.0000    0.0000  487.8357  395.0842  402.5681    0.0000    0.0000    0.0000    0.0000 (102)
Total gains      0.0000    0.0000    0.0000    0.0000    0.0000  701.5298  675.4734  650.4242    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  153.8597  208.6096  184.4049    0.0000    0.0000    0.0000    0.0000 (104)
Space cooling                                                                                                             546.8741 (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	38.4649	52.1524	46.1012	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												136.7185	(107)
Space cooling per m2												2.3483	(108)
Energy for space heating												28.5758	(99)
Energy for space cooling												2.3483	(108)
Total												30.9241	(109)
Dwelling Fabric Energy Efficiency (DFEE)												30.9	(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	58.2200 (1b)	x	2.4000 (2b)	=	139.7280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	139.7280	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1431	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3931	(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) =	0.3047	(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	0.3885	0.3808	0.3732	0.3351	0.3275	0.2894	0.2894	0.2818	0.3047	0.3275	0.3428	0.3580	(22b)
Effective ac	0.5755	0.5725	0.5697	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5587	0.5641	(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)			7.8600	1.3258	10.4205			(27)
WT-E-01	33.5500	7.8600	25.6900	0.1800	4.6242			(29a)
WT-I-01	26.6400	2.1200	24.5200	0.1800	4.4136			(29a)
Total net area of external elements Aum(A, m2)			60.1900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.5783			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0637	(36)
Total fabric heat loss					(33) + (36) =		26.6420	(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	26.5343	26.3992	26.2668	25.6448	25.5284	24.9867	24.9867	24.8863	25.1953	25.5284	25.7638	26.0099	(38)
Heat transfer coeff	53.1762	53.0411	52.9087	52.2867	52.1703	51.6286	51.6286	51.5283	51.8373	52.1703	52.4058	52.6519	(39)
Average = Sum(39)m / 12 =												52.2862	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9134	0.9110	0.9088	0.8981	0.8961	0.8868	0.8868	0.8851	0.8904	0.8961	0.9001	0.9044	(40)
HLP (average)												0.8981	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9309	(42)
Average daily hot water use (litres/day)	80.0585	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.0644	84.8620	81.6597	78.4574	75.2550	72.0527	72.0527	75.2550	78.4574	81.6597	84.8620	88.0644	(44)
Energy conte	130.5969	114.2209	117.8657	102.7582	98.5989	85.0834	78.8423	90.4727	91.5532	106.6964	116.4675	126.4761	(45)
Energy content (annual)										Total = Sum(45)m =		1259.6323	(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
                27.7518    24.2719    25.0465    21.8361    20.9523    18.0802    16.7540    19.2254    19.4551    22.6730    24.7493    26.8762 (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           96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443    96.5443 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                16.2383    14.4227    11.7293     8.8798     6.6378     5.6039     6.0552     7.8708    10.5642    13.4136    15.6557    16.6896 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               168.4365   170.1843   165.7798   156.4031   144.5667   133.4422   126.0104   124.2625   128.6670   138.0437   149.8801   161.0046 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544    32.6544 (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)
               -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354 (71)
Water heating gains (Table 5)
                37.3009    36.1190    33.6646    30.3279    28.1617    25.1114    22.5188    25.8406    27.0209    30.4744    34.3741    36.1239 (72)
Total internal gains
               273.9389   272.6892   263.1370   247.5742   231.3295   216.1208   206.5476   209.9372   218.2154   233.8951   251.8731   265.7813 (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
-----------------------------------------------------------------------------------------------------------------------------------
Southeast                                 7.8600          36.7938          0.6300           0.7000          0.7700          88.3831 (77)
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Solar gains     88.3831   150.5492   205.9879   255.2291   285.8778   283.8105   273.6236   250.7583   223.0414   166.3889   105.8626    75.6375 (83)
Total gains    362.3220   423.2384   469.1249   502.8032   517.2073   499.9313   480.1712   460.6955   441.2567   400.2840   357.7357   341.4189 (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             76.0312    76.2249    76.4157    77.3247    77.4972    78.3104    78.3104    78.4628    77.9951    77.4972    77.1491    76.7884
alpha            6.0687     6.0817     6.0944     6.1550     6.1665     6.2207     6.2207     6.2309     6.1997     6.1665     6.1433     6.1192
util living area
                 0.9974     0.9929     0.9800     0.9381     0.8315     0.6430     0.4707     0.5105     0.7570     0.9547     0.9935     0.9982 (86)

MIT             20.1122    20.2685    20.4813    20.7278    20.9068    20.9848    20.9981    20.9969    20.9600    20.7287    20.3696    20.0818 (87)
Th 2            20.1562    20.1581    20.1601    20.1691    20.1708    20.1787    20.1787    20.1802    20.1757    20.1708    20.1674    20.1638 (88)
util rest of house
                 0.9966     0.9906     0.9736     0.9186     0.7847     0.5681     0.3842     0.4217     0.6861     0.9362     0.9911     0.9976 (89)
MIT 2           19.3435    19.5003    19.7112    19.9538    20.1098    20.1719    20.1782    20.1793    20.1550    19.9601    19.6092    19.3196 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.4483 (91)
MIT             19.6881    19.8447    20.0564    20.3008    20.4671    20.5363    20.5458    20.5458    20.5159    20.3047    19.9501    19.6613 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT    19.6881    19.8447    20.0564    20.3008    20.4671    20.5363    20.5458    20.5458    20.5159    20.3047    19.9501    19.6613 (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      0.9960     0.9896     0.9726     0.9220     0.8025     0.6014     0.4231     0.4616     0.7167     0.9396     0.9903     0.9971 (94)
Useful gains   360.8788   418.8447   456.2871   463.6038   415.0479   300.6631   203.1473   212.6699   316.2568   376.1115   354.2556   340.4443 (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
               818.2804   792.6839   717.2538   596.1103   457.3825   306.4846   203.7144   213.6274   332.5811   506.2951   673.4188   814.0654 (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
               340.3068   251.2199   194.1593    95.4047    31.4969     0.0000     0.0000     0.0000     0.0000    96.8566   229.7975   352.3741 (98)
Space heating                                                                                                                    1591.6157 (98)
Space heating per m2                                                                                                 (98) / (4) =     27.3380 (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   485.3089   382.0517   391.6150     0.0000     0.0000     0.0000     0.0000 (100)
Utilisation      0.0000     0.0000     0.0000     0.0000     0.0000     0.9553     0.9824     0.9766     0.0000     0.0000     0.0000     0.0000 (101)
Useful loss      0.0000     0.0000     0.0000     0.0000     0.0000   463.6236   375.3101   382.4655     0.0000     0.0000     0.0000     0.0000 (102)
Total gains      0.0000     0.0000     0.0000     0.0000     0.0000   657.1491   632.6857   611.2120     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   139.3384   191.4874   170.1874     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                    501.0132 (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
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	34.8346	47.8719	42.5468	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												125.2533	(107)
Space cooling per m2												2.1514	(108)
Energy for space heating												27.3380	(99)
Energy for space cooling												2.1514	(108)
Total												29.4893	(109)
Target Fabric Energy Efficiency (TFEE)												33.9	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.2200 (1b)	x	2.4000 (2b)	=	139.7280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	139.7280	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.2005	(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) =	0.1554	(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	0.1632	0.1554	0.1554	0.1437	0.1437	0.1282	0.1321	0.1243	0.1282	0.1360	0.1360	0.1476	(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)			7.8600	1.2357	9.7129			(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380			(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861			(29a)
Total net area of external elements Aum(A, m2)			60.1900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.0570			(33)
Party Wall 1			14.8800	0.0000	0.0000			(32)
Party Floor 1			58.2200					(32d)
Party Ceilings 1			58.2200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8433	(36)
Total fabric heat loss (33) + (36) =	29.9003	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	(38)
Heat transfer coeff	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	(39)
Average = Sum(39)m / 12 =												52.9554	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	(40)
HLP (average)												0.9096	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9309	(42)
Average daily hot water use (litres/day)	80.0585	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.0644	84.8620	81.6597	78.4574	75.2550	72.0527	72.0527	75.2550	78.4574	81.6597	84.8620	88.0644	(44)
Energy conte	130.5969	114.2209	117.8657	102.7582	98.5989	85.0834	78.8423	90.4727	91.5532	106.6964	116.4675	126.4761	(45)
Energy content (annual)										Total = Sum(45)m =		1259.6323	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5895	17.1331	17.6799	15.4137	14.7898	12.7625	11.8263	13.5709	13.7330	16.0045	17.4701	18.9714	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0326	12.6579	13.9876	13.5063	13.9346	13.4599	13.8929	13.9200	13.4852	13.9657	13.5500	14.0239	(61)
Total heat required for water heating calculated for each month	144.6295	126.8788	131.8533	116.2645	112.5336	98.5433	92.7352	104.3926	105.0384	120.6621	130.0175	140.5000	(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	144.6295	126.8788	131.8533	116.2645	112.5336	98.5433	92.7352	104.3926	105.0384	120.6621	130.0175	140.5000	(64)
Total per year (kWh/year) = Sum(64)m =												1424.0488	(64)
RHI water heating demand												1424	(64)
Heat gains from water heating, kWh/month	46.9316	41.1429	42.6872	37.5437	36.2678	31.6552	29.6883	33.5622	33.8127	38.9680	42.1129	45.5593	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	115.8531	115.8531	115.8531	115.8531	115.8531	115.8531	115.8531	115.8531	115.8531	115.8531	115.8531	115.8531	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.5956	36.0567	29.3233	22.1996	16.5945	14.0097	15.1380	19.6770	26.4104	33.5341	39.1392	41.7239	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.3977	254.0064	247.4325	233.4375	215.7713	199.1675	188.0752	185.4664	192.0403	206.0354	223.7016	240.3054	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.5162	48.5162	48.5162	48.5162	48.5162	48.5162	48.5162	48.5162	48.5162	48.5162	48.5162	48.5162	(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)	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	-77.2354	(71)
Water heating gains (Table 5)	63.0801	61.2246	57.3753	52.1440	48.7471	43.9656	39.9036	45.1104	46.9621	52.3763	58.4902	61.2356	(72)
Total internal gains	445.2074	441.4216	424.2650	397.9150	371.2467	347.2767	333.2507	340.3877	355.5468	382.0796	411.4649	433.3988	(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	
Southeast	7.8600	40.4699	0.4500	0.0000	0.7700	110.2194	(77)

Solar gains	110.2194	168.8930	228.6385	293.3843	321.8731	342.8585	326.6073	304.6829	268.7790	199.3559	135.2254	93.4358	(83)
Total gains	555.4268	610.3146	652.9036	691.2993	693.1198	690.1352	659.8580	645.0706	624.3257	581.4356	546.6903	526.8346	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	76.3483	76.3483	76.3483	76.3483	76.3483	76.3483	76.3483	76.3483	76.3483	76.3483	76.3483	76.3483	
alpha	6.0899	6.0899	6.0899	6.0899	6.0899	6.0899	6.0899	6.0899	6.0899	6.0899	6.0899	6.0899	
util living area	0.9715	0.9506	0.8974	0.7809	0.5990	0.3830	0.2487	0.2626	0.4886	0.7845	0.9372	0.9777	(86)
MIT	20.4899	20.6030	20.7735	20.9191	20.9857	20.9992	21.0000	20.9999	20.9965	20.9297	20.7030	20.4485	(87)
Th 2	20.1594	20.1594	20.1594	20.1594	20.1594	20.1594	20.1594	20.1594	20.1594	20.1594	20.1594	20.1594	(88)
util rest of house	0.9637	0.9380	0.8732	0.7385	0.5406	0.3189	0.1813	0.1937	0.4194	0.7341	0.9188	0.9713	(89)
MIT 2	19.7170	19.8244	19.9813	20.1041	20.1519	20.1591	20.1594	20.1594	20.1581	20.1147	19.9205	19.6773	(90)
Living area fraction									fLA = Living area / (4) =			0.4483	(91)
MIT	20.0635	20.1734	20.3365	20.4695	20.5257	20.5357	20.5362	20.5362	20.5339	20.4801	20.2713	20.0230	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.9135	20.0234	20.1865	20.3195	20.3757	20.3857	20.3862	20.3862	20.3839	20.3301	20.1213	19.8730	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9610	0.9356	0.8741	0.7470	0.5559	0.3362	0.1995	0.2123	0.4380	0.7449	0.9179	0.9687	(94)
Useful gains	533.7442	571.0210	570.7014	516.3984	385.3084	232.0451	131.6521	136.9443	273.4810	433.1152	501.8066	510.3476	(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	784.4534	763.7996	677.1122	551.7672	390.5835	232.2482	131.6579	136.9529	274.5165	462.3061	641.8879	782.3114	(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	186.5277	129.5473	79.1697	25.4655	3.9247	0.0000	0.0000	0.0000	0.0000	21.7180	100.8586	202.3410	(98)
Space heating												749.5524	(98)
RHI space heating demand												750	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.2200 (1b)	x	2.4000 (2b)	=	139.7280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.2200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	139.7280	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.2005	(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) =	0.1554	(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	0.1981	0.1942	0.1903	0.1709	0.1670	0.1476	0.1476	0.1437	0.1554	0.1670	0.1748	0.1826	(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)			7.8600	1.2357	9.7129			(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380			(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861			(29a)
Total net area of external elements Aum(A, m2)			60.1900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.0570			(33)
Party Wall 1			14.8800	0.0000	0.0000			(32)
Party Floor 1			58.2200					(32d)
Party Ceilings 1			58.2200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8433	(36)
Total fabric heat loss (33) + (36) =	29.9003	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	(38)
Heat transfer coeff	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	(39)
Average = Sum(39)m / 12 =												52.9554	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	(40)
HLP (average)												0.9096	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9309	(42)
Average daily hot water use (litres/day)	80.0585	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.0644	84.8620	81.6597	78.4574	75.2550	72.0527	72.0527	75.2550	78.4574	81.6597	84.8620	88.0644	(44)
Energy conte	130.5969	114.2209	117.8657	102.7582	98.5989	85.0834	78.8423	90.4727	91.5532	106.6964	116.4675	126.4761	(45)
Energy content (annual)										Total = Sum(45)m =		1259.6323	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5895	17.1331	17.6799	15.4137	14.7898	12.7625	11.8263	13.5709	13.7330	16.0045	17.4701	18.9714	(46)

CALCULATION OF ENERGY RATINGS 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     14.0326    12.6579    13.9876    13.5063    13.9346    13.4599    13.8929    13.9200    13.4852    13.9657    13.5500    14.0239 (61)
Total heat required for water heating calculated for each month
              144.6295   126.8788   131.8533   116.2645   112.5336    98.5433    92.7352   104.3926   105.0384   120.6621   130.0175   140.5000 (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
              144.6295   126.8788   131.8533   116.2645   112.5336    98.5433    92.7352   104.3926   105.0384   120.6621   130.0175   140.5000 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1424.0488 (64)
Heat gains from water heating, kWh/month
               46.9316    41.1429    42.6872    37.5437    36.2678    31.6552    29.6883    33.5622    33.8127    38.9680    42.1129    45.5593 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m          115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               40.5956    36.0567    29.3233    22.1996    16.5945    14.0097    15.1380    19.6770    26.4104    33.5341    39.1392    41.7239 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              251.3977   254.0064   247.4325   233.4375   215.7713   199.1675   188.0752   185.4664   192.0403   206.0354   223.7016   240.3054 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162 (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)
              -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354 (71)
Water heating gains (Table 5)
               63.0801    61.2246    57.3753    52.1440    48.7471    43.9656    39.9036    45.1104    46.9621    52.3763    58.4902    61.2356 (72)
Total internal gains
              445.2074   441.4216   424.2650   397.9150   371.2467   347.2767   333.2507   340.3877   355.5468   382.0796   411.4649   433.3988 (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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Southeast                                 7.8600         36.7938          0.4500            0.0000          0.7700         100.2076 (77)
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Solar gains   100.2076   170.6907   233.5464   289.3753   324.1245   321.7806   310.2308   284.3064   252.8814   188.6496   120.0257    85.7569 (83)
Total gains   545.4150   612.1123   657.8115   687.2903   695.3712   669.0573   643.4815   624.6941   608.4281   570.7292   531.4906   519.1556 (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            76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483
alpha           6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899
util living area
                0.9791     0.9586     0.9161     0.8271     0.6806     0.5026     0.3616     0.3892     0.5895     0.8432     0.9575     0.9840 (86)

MIT            20.4090    20.5515    20.7213    20.8781    20.9675    20.9955    20.9995    20.9992    20.9887    20.8827    20.6168    20.3609 (87)
Th 2           20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594 (88)
util rest of house
                0.9735     0.9481     0.8963     0.7913     0.6277     0.4384     0.2928     0.3185     0.5223     0.8027     0.9449     0.9795 (89)
MIT 2          19.6383    19.7752    19.9337    20.0710    20.1400    20.1575    20.1592    20.1592    20.1541    20.0782    19.8399    19.5915 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.4483 (91)
MIT            19.9838    20.1232    20.2868    20.4328    20.5110    20.5332    20.5359    20.5357    20.5282    20.4389    20.1882    19.9364 (92)
Temperature adjustment                                                                                                           -0.1500
adjusted MIT   19.8338    19.9732    20.1368    20.2828    20.3610    20.3832    20.3859    20.3857    20.3782    20.2889    20.0382    19.7864 (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     0.9708     0.9454     0.8957     0.7969     0.6408     0.4556     0.3114     0.3376     0.5401     0.8094     0.9428     0.9771 (94)
Useful gains  529.5023   578.6831   589.2082   547.7288   445.5805   304.8203   200.3714   210.8780   328.6117   461.9495   501.0783   507.2716 (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
              822.5980   798.2082   722.1422   602.7827   458.6471   306.2497   200.4851   211.0666   332.4670   513.0783   685.1471   825.3868 (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
              218.0632   147.5209    98.9029    39.6388     9.7216     0.0000     0.0000     0.0000     0.0000    38.0399   132.5296   236.6778 (98)
Space heating                                                                                                                     921.0946 (98)
Space heating per m2                                                                                                (98) / (4) =   15.8209 (99)


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8c. Space cooling requirement
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Not applicable
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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	1017.7841	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	218.0632	147.5209	98.9029	39.6388	9.7216	0.0000	0.0000	0.0000	0.0000	38.0399	132.5296	236.6778	(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)	240.9538	163.0065	109.2850	43.7998	10.7421	0.0000	0.0000	0.0000	0.0000	42.0330	146.4415	261.5224	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	144.6295	126.8788	131.8533	116.2645	112.5336	98.5433	92.7352	104.3926	105.0384	120.6621	130.0175	140.5000	(64)
Efficiency of water heater (217)m	89.1962	88.9917	88.6434	88.0920	87.5462	87.3000	87.3000	87.3000	87.3000	88.0462	88.8865	89.2809	(217)
Fuel for water heating, kWh/month	162.1476	142.5738	148.7458	131.9808	128.5420	112.8790	106.2259	119.5792	120.3189	137.0440	146.2736	157.3684	(219)

Water heating fuel used	1613.6789	(219)
Annual totals kWh/year		
Space heating fuel - main system	1017.7841	(211)
Space heating fuel - secondary	0.0000	(215)

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

mechanical ventilation fans (SFP = 0.1840)	31.3661	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	106.3661	(231)
Electricity for lighting (calculated in Appendix L)	286.7727	(232)
Total delivered energy for all uses	3024.6018	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1017.7841	3.4800	35.4189	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1613.6789	3.4800	56.1560	(247)
Mechanical ventilation fans	31.3661	13.1900	4.1372	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	286.7727	13.1900	37.8253	(250)
Additional standing charges			120.0000	(251)
Total energy cost			263.4299	(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] =	1.0719	(257)
SAP value		85.0471	
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	1017.7841	0.2160	219.8414	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1613.6789	0.2160	348.5546	(264)
Space and water heating			568.3960	(265)
Pumps and fans	106.3661	0.5190	55.2040	(267)
Energy for lighting	286.7727	0.5190	148.8350	(268)
Total kg/year			772.4351	(272)
CO2 emissions per m2			13.2700	(273)
EI value			89.9723	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9050 = 3.845, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9050 = 0.2387, stars = 4
Water heating energy efficiency	3.48 / 0.8816 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8816 = 0.2450, 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	58.2200 (1b)	x	2.4000 (2b)	=	139.7280	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	58.2200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		139.7280	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.2005	(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) =	0.1554	(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	0.1632	0.1554	0.1554	0.1437	0.1437	0.1282	0.1321	0.1243	0.1282	0.1360	0.1360	0.1476	(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)			7.8600	1.2357	9.7129			(27)
WT-E-01	33.5500	7.8600	25.6900	0.2000	5.1380			(29a)
WT-I-01	26.6400	2.1200	24.5200	0.2890	7.0861			(29a)
Total net area of external elements Aum(A, m2)			60.1900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.0570			(33)
Party Wall 1			14.8800	0.0000	0.0000			(32)
Party Floor 1			58.2200					(32d)
Party Ceilings 1			58.2200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8433	(36)
Total fabric heat loss (33) + (36) =	29.9003	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	23.0551	(38)
Heat transfer coeff	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	52.9554	(39)
Average = Sum(39)m / 12 =												52.9554	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	0.9096	(40)
HLP (average)												0.9096	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9309	(42)
Average daily hot water use (litres/day)	80.0585	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.0644	84.8620	81.6597	78.4574	75.2550	72.0527	72.0527	75.2550	78.4574	81.6597	84.8620	88.0644	(44)
Energy conte	130.5969	114.2209	117.8657	102.7582	98.5989	85.0834	78.8423	90.4727	91.5532	106.6964	116.4675	126.4761	(45)
Energy content (annual)										Total = Sum(45)m =		1259.6323	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5895	17.1331	17.6799	15.4137	14.7898	12.7625	11.8263	13.5709	13.7330	16.0045	17.4701	18.9714	(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     14.0326    12.6579    13.9876    13.5063    13.9346    13.4599    13.8929    13.9200    13.4852    13.9657    13.5500    14.0239 (61)
Total heat required for water heating calculated for each month
              144.6295   126.8788   131.8533   116.2645   112.5336    98.5433    92.7352   104.3926   105.0384   120.6621   130.0175   140.5000 (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
              144.6295   126.8788   131.8533   116.2645   112.5336    98.5433    92.7352   104.3926   105.0384   120.6621   130.0175   140.5000 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1424.0488 (64)
Heat gains from water heating, kWh/month
               46.9316    41.1429    42.6872    37.5437    36.2678    31.6552    29.6883    33.5622    33.8127    38.9680    42.1129    45.5593 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531   115.8531 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               40.5956    36.0567    29.3233    22.1996    16.5945    14.0097    15.1380    19.6770    26.4104    33.5341    39.1392    41.7239 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              251.3977   254.0064   247.4325   233.4375   215.7713   199.1675   188.0752   185.4664   192.0403   206.0354   223.7016   240.3054 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162    48.5162 (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)
              -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354   -77.2354 (71)
Water heating gains (Table 5)
               63.0801    61.2246    57.3753    52.1440    48.7471    43.9656    39.9036    45.1104    46.9621    52.3763    58.4902    61.2356 (72)
Total internal gains
              445.2074   441.4216   424.2650   397.9150   371.2467   347.2767   333.2507   340.3877   355.5468   382.0796   411.4649   433.3988 (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
-----------------------------------------------------------------------------------------------------------------------------------
Southeast                                 7.8600         40.4699          0.4500            0.0000          0.7700         110.2194 (77)
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Solar gains   110.2194   168.8930   228.6385   293.3843   321.8731   342.8585   326.6073   304.6829   268.7790   199.3559   135.2254    93.4358 (83)
Total gains   555.4268   610.3146   652.9036   691.2993   693.1198   690.1352   659.8580   645.0706   624.3257   581.4356   546.6903   526.8346 (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            76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483    76.3483
alpha           6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899     6.0899
util living area
                0.9715     0.9506     0.8974     0.7809     0.5990     0.3830     0.2487     0.2626     0.4886     0.7845     0.9372     0.9777 (86)

MIT            20.4899    20.6030    20.7735    20.9191    20.9857    20.9992    21.0000    20.9999    20.9965    20.9297    20.7030    20.4485 (87)
Th 2           20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594    20.1594 (88)
util rest of house
                0.9637     0.9380     0.8732     0.7385     0.5406     0.3189     0.1813     0.1937     0.4194     0.7341     0.9188     0.9713 (89)
MIT 2          19.7170    19.8244    19.9813    20.1041    20.1519    20.1591    20.1594    20.1594    20.1581    20.1147    19.9205    19.6773 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.4483 (91)
MIT            20.0635    20.1734    20.3365    20.4695    20.5257    20.5357    20.5362    20.5362    20.5339    20.4801    20.2713    20.0230 (92)
Temperature adjustment                                                                                                           -0.1500
adjusted MIT   19.9135    20.0234    20.1865    20.3195    20.3757    20.3857    20.3862    20.3862    20.3839    20.3301    20.1213    19.8730 (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     0.9610     0.9356     0.8741     0.7470     0.5559     0.3362     0.1995     0.2123     0.4380     0.7449     0.9179     0.9687 (94)
Useful gains  533.7442   571.0210   570.7014   516.3984   385.3084   232.0451   131.6521   136.9443   273.4810   433.1152   501.8066   510.3476 (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
              784.4534   763.7996   677.1122   551.7672   390.5835   232.2482   131.6579   136.9529   274.5165   462.3061   641.8879   782.3114 (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
              186.5277   129.5473    79.1697    25.4655     3.9247     0.0000     0.0000     0.0000     0.0000    21.7180   100.8586   202.3410 (98)
Space heating                                                                                                                     749.5524 (98)
Space heating per m2                                                                                                 (98) / (4) =     12.8745 (99)


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

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	828.2347	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	186.5277	129.5473	79.1697	25.4655	3.9247	0.0000	0.0000	0.0000	0.0000	21.7180	100.8586	202.3410	(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)	206.1079	143.1461	87.4803	28.1387	4.3367	0.0000	0.0000	0.0000	0.0000	23.9978	111.4459	223.5813	(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	144.6295	126.8788	131.8533	116.2645	112.5336	98.5433	92.7352	104.3926	105.0384	120.6621	130.0175	140.5000	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.0740	88.8879	88.4737	87.8582	87.4042	87.3000	87.3000	87.3000	87.3000	87.7734	88.6697	89.1607	(217)
Fuel for water heating, kWh/month	162.3700	142.7403	149.0311	132.3320	128.7508	112.8790	106.2259	119.5792	120.3189	137.4700	146.6313	157.5807	(219)
Water heating fuel used												1615.9092	(219)

Annual totals kWh/year		
Space heating fuel - main system	828.2347	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)		
mechanical ventilation fans (SFP = 0.1840)	31.3661	(230a)
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	106.3661	(231)
Electricity for lighting (calculated in Appendix L)	286.7727	(232)
Total delivered energy for all uses	2837.2828	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	828.2347	3.6300	30.0649	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1615.9092	3.6300	58.6575	(247)
Mechanical ventilation fans	31.3661	19.4400	6.0976	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	286.7727	19.4400	55.7486	(250)
Additional standing charges			95.0000	(251)
Total energy cost			260.1486	(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	828.2347	0.2160	178.8987	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1615.9092	0.2160	349.0364	(264)
Space and water heating			527.9351	(265)
Pumps and fans	106.3661	0.5190	55.2040	(267)
Energy for lighting	286.7727	0.5190	148.8350	(268)
Total kg/year			731.9741	(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	828.2347	1.2200	1010.4463	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1615.9092	1.2200	1971.4093	(264)
Space and water heating			2981.8556	(265)
Pumps and fans	106.3661	3.0700	326.5441	(267)
Energy for lighting	286.7727	3.0700	880.3922	(268)
Primary energy kWh/year			4188.7918	(272)
Primary energy kWh/m2/year			71.9476	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 85
Current environmental impact rating:	B 90

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

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 90

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

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

	Current	Potential	Saving
Electricity	£76	£76	£0
Mains gas	£184	£184	£0
Space heating	£146	£146	£0
Water heating	£59	£59	£0
Lighting	£56	£56	£0
Total cost of fuels	£260	£260	£0
Total cost of uses	£261	£261	£0
Delivered energy	49 kWh/m²	49 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	72 kWh/m²	72 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North 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	276.66	(P1)
Transmission heat loss coefficient	29.90	(37)
Summer heat loss coefficient	306.56	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South East	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
South 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
South East	7.8600	119.9223	0.4500	0.0000	0.9000	381.7488
total:						381.7488

	Jun	Jul	Aug	
Solar gains	401	382	356	(P4)
Internal gains	344	330	337	
Total summer gains	745	712	694	(P5)
Summer gain/loss ratio	2.43	2.32	2.26	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.68	20.47	20.31	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant