

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Combi 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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) | |
| Total heat required for water heating calculated for each month | 47.1670 | 41.0533 | 43.7367 | 40.6660 | 40.3063 | 37.3463 | 38.5912 | 40.3063 | 40.6660 | 43.7367 | 43.9856 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | (61) |
| Solar input | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (62) |
| Output from w/h | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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) |
| Heat gains from water heating, kWh/month | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (64) |
| | 57.4314 | 50.1800 | 52.1247 | 46.0774 | 44.5339 | 39.0706 | 37.2008 | 41.6940 | 42.1615 | 48.2213 | 51.6983 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (66)m |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.8378 | 14.9552 | 12.1624 | 9.2077 | 6.8829 | 5.8108 | 6.2788 | 8.1614 | 10.9542 | 13.9089 | 16.2337 | 17.3058 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table b) | 77.1927 | 74.6727 | 70.0600 | 63.9963 | 59.8574 | 54.2648 | 50.0010 | 56.0404 | 58.5577 | 64.8136 | 71.8031 | 75.2571 | (72) |
| Total internal gains | 335.4665 | 332.9721 | 320.7580 | 301.5025 | 282.1163 | 263.3063 | 251.3967 | 257.4104 | 267.5292 | 286.9769 | 309.2137 | 325.8851 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 5a W/m2 | Specific data or Table 5b | g | Specific data or Table 5c | FF | Access factor Table 5d | Gains W | | | | | |
|-------------|----------|--------------------------|---------------------------|----------|---------------------------|----------|------------------------|----------|----------|----------|----------|----------|------|
| Southeast | 3.4400 | 36.7938 | 0.6300 | 0.6300 | 0.7000 | 0.7700 | 38.6817 | (77) | | | | | |
| Southwest | 1.3200 | 36.7938 | 0.6300 | 0.6300 | 0.7000 | 0.7700 | 14.8430 | (79) | | | | | |
| Northwest | 6.4500 | 11.2829 | 0.6300 | 0.6300 | 0.7000 | 0.7700 | 22.2410 | (81) | | | | | |
| Solar gains | 75.7656 | 136.4444 | 206.3119 | 288.5210 | 353.1886 | 363.8398 | 345.2849 | 295.0212 | 234.4629 | 156.0909 | 92.0951 | 63.9690 | (83) |
| Total gains | 411.2322 | 469.4165 | 527.0699 | 590.0235 | 635.3049 | 627.1460 | 596.6816 | 552.4316 | 501.9921 | 443.0678 | 401.3088 | 389.8542 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Thl (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (85) |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 0.9974 | 0.9945 | 0.9859 | 0.9552 | 0.8674 | 0.6991 | 0.5327 | 0.5926 | 0.8416 | 0.9729 | 0.9947 | 0.9980 | (86) |
| MIT | 19.7586 | 19.9103 | 20.1657 | 20.5051 | 20.7932 | 20.9501 | 20.9896 | 20.9828 | 20.8704 | 20.4990 | 20.0675 | 19.7306 | (87) |
| Th 2 | 19.9387 | 19.9408 | 19.9429 | 19.9525 | 19.9544 | 19.9628 | 19.9628 | 19.9644 | 19.9596 | 19.9544 | 19.9507 | 19.9468 | (88) |
| util rest of house | 0.9965 | 0.9926 | 0.9808 | 0.9384 | 0.8196 | 0.6070 | 0.4133 | 0.4698 | 0.7683 | 0.9596 | 0.9925 | 0.9973 | (89) |
| MIT 2 | 18.2907 | 18.5132 | 18.8849 | 19.3733 | 19.7529 | 19.9300 | 19.9591 | 19.9574 | 19.8558 | 19.3741 | 18.7503 | 18.2556 | (90) |
| Living area fraction | 18.6814 | 18.8850 | 19.2258 | 19.6746 | 20.0298 | 20.2015 | 20.2333 | 20.2303 | 20.1258 | 19.6735 | 19.1009 | 18.6482 | (92) |
| MIT | 18.6814 | 18.8850 | 19.2258 | 19.6746 | 20.0298 | 20.2015 | 20.2333 | 20.2303 | 20.1258 | 19.6735 | 19.1009 | 18.6482 | (92) |
| Temperature adjustment | | | | | | | | | | | | | 0.0000 |
| adjusted MIT | 18.6814 | 18.8850 | 19.2258 | 19.6746 | 20.0298 | 20.2015 | 20.2333 | 20.2303 | 20.1258 | 19.6735 | 19.1009 | 18.6482 | (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (94) |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------------|
| Useful gains | 409.1375 | 464.6656 | 514.5161 | 550.3999 | 523.2194 | 394.8382 | 265.6722 | 277.6352 | 392.4057 | 423.0406 | 397.2696 | 388.3087 | (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 | 1089.8092 | 1057.4181 | 960.1102 | 804.5533 | 620.7897 | 413.6809 | 268.3301 | 282.3962 | 446.5857 | 676.2198 | 897.9036 | 1085.4372 | (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 | 506.4197 | 398.3297 | 331.5220 | 182.9904 | 72.5924 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 188.3653 | 360.4565 | 518.6636 | (98) |
| Space heating | | | | | | | | | | | | | 2559.3396 |
| Space heating per m2 | | | | | | | | | | | | | (98) / (4) = 39.7413 |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 %) | | | | | | | | | | | | | 93.4000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2740.1922 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 506.4197 | 398.3297 | 331.5220 | 182.9904 | 72.5924 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 188.3653 | 360.4565 | 518.6636 | (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) | 542.2052 | 426.4772 | 354.9486 | 195.9212 | 77.7220 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 201.6759 | 385.9277 | 555.3144 | (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 | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | (64) |
| Efficiency of water heater (217)m | 87.4632 | 87.2401 | 86.7364 | 85.5752 | 83.4248 | 80.3000 | 80.3000 | 80.3000 | 80.3000 | 85.5288 | 86.9461 | 87.5614 | (217) |
| Fuel for water heating, kWh/month | 210.8648 | 184.6670 | 193.2496 | 173.7286 | 172.5355 | 157.8730 | 151.2544 | 168.6132 | 170.4753 | 182.2527 | 191.3797 | 205.6819 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2162.5758 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2740.1922 (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) | | | | | | | | | | | | | 297.3610 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5275.1290 (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 | 2740.1922 | 0.2160 | 591.8815 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 2162.5758 | 0.2160 | 467.1164 (264) |
| Space and water heating | | | 1058.9979 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 297.3610 | 0.5190 | 154.3304 (268) |
| Total CO2, kg/m2/year | | | 1252.2533 (272) |
| Emissions per m2 for space and water heating | | | 16.4441 (272a) |
| Fuel factor (mains gas) | | | 1.0000 |
| Emissions per m2 for lighting | | | 2.3964 (272b) |
| Emissions per m2 for pumps and fans | | | 0.6044 (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (16.4441 * 1.00) + 2.3964 + 0.6044, rounded to 2 d.p. | | | 19.4400 (273) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.3780 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3213 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4097 | 0.4017 | 0.3936 | 0.3535 | 0.3454 | 0.3053 | 0.3053 | 0.2972 | 0.3213 | 0.3454 | 0.3615 | 0.3776 (22b) |
| Effective ac | 0.5839 | 0.5807 | 0.5775 | 0.5625 | 0.5597 | 0.5466 | 0.5466 | 0.5442 | 0.5516 | 0.5597 | 0.5653 | 0.5713 (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 (Uw = 1.41) | | | 11.2100 | 1.3347 | 14.9622 | | (27) | | | | | |
| Opening Type 9 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm B&B | | | 32.2000 | 0.1400 | 4.5080 | | (28a) | | | | | |
| 50mm Alreflex Plat | 78.2900 | 13.1800 | 65.1100 | 0.2700 | 17.5797 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1100 | 3.5420 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 142.6900 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 42.5619 | (33) | | | | | |
| E-WM-20/22 | | | 37.2800 | 0.0000 | 0.0000 | | (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 176.5300 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 6.3199 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 48.8818 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2174 | Feb 30.0488 | Mar 29.8835 | Apr 29.1070 | May 28.9617 | Jun 28.2855 | Jul 28.2855 | Aug 28.1602 | Sep 28.5460 | Oct 28.9617 | Nov 29.2556 | Dec 29.5629 (38) |
| Heat transfer coeff | 79.0992 | 78.9306 | 78.7653 | 77.9888 | 77.8435 | 77.1673 | 77.1673 | 77.0420 | 77.4278 | 77.8435 | 78.1374 | 78.4447 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 77.9881 (39) |
| HLP | Jan 1.2282 | Feb 1.2256 | Mar 1.2231 | Apr 1.2110 | May 1.2088 | Jun 1.1982 | Jul 1.1982 | Aug 1.1963 | Sep 1.2023 | Oct 1.2088 | Nov 1.2133 | Dec 1.2181 (40) |
| HLP (average) | | | | | | | | | | | | 1.2110 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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 | 0.0000 (59) |
| Heat gains from water heating, kWh/month | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | (65) |

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.8378 | 14.9552 | 12.1624 | 9.2077 | 6.8829 | 5.8108 | 6.2788 | 8.1614 | 10.9542 | 13.9089 | 16.2337 | 17.3058 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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 c.g. evaporation (negative values) (Table 5) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) |
| Total internal gains | 294.4784 | 293.2618 | 283.0807 | 266.3819 | 248.8578 | 232.4345 | 222.0637 | 225.5295 | 234.3715 | 251.1930 | 270.5390 | 285.5955 | (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 | | 3.4400 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 43.5936 | (77) | | | | | |
| Southwest | | 1.3200 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 16.7278 | (79) | | | | | |
| Northwest | | 6.4500 | 11.2829 | 0.7100 | 0.7000 | 0.7700 | 25.0652 | (81) | | | | | |
| Solar gains | 85.3867 | 153.7707 | 232.5102 | 325.1586 | 398.0379 | 410.0416 | 389.1306 | 332.4842 | 264.2359 | 175.9120 | 103.7897 | 72.0921 | (83) |
| Total gains | 379.8650 | 447.0325 | 515.5909 | 591.5406 | 646.8957 | 642.4762 | 611.1944 | 558.0137 | 498.6074 | 427.1051 | 374.3287 | 357.6876 | (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | | 21.0000 | (85) |
| Utilisation factor for gains for living area, nll,m (see Table 9a) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| tau | 39.9236 | 40.0089 | 40.0929 | 40.4920 | 40.5676 | 40.9231 | 40.9231 | 40.9896 | 40.7854 | 40.5676 | 40.4150 | 40.2567 | | |
| alpha | 3.6616 | 3.6673 | 3.6729 | 3.6995 | 3.7045 | 3.7282 | 3.7282 | 3.7326 | 3.7190 | 3.7045 | 3.6943 | 3.6838 | | |
| util living area | 0.9925 | 0.9858 | 0.9697 | 0.9254 | 0.8293 | 0.6750 | 0.5261 | 0.5869 | 0.8144 | 0.9535 | 0.9871 | 0.9940 | | (86) |
| MIT | 19.2396 | 19.4509 | 19.8010 | 20.2580 | 20.6488 | 20.8869 | 20.9662 | 20.9495 | 20.7595 | 20.2462 | 19.6588 | 19.2010 | | (87) |
| Th 2 | 19.8975 | 19.8996 | 19.9016 | 19.9112 | 19.9130 | 19.9214 | 19.9214 | 19.9230 | 19.9182 | 19.9130 | 19.9094 | 19.9056 | | (88) |
| util rest of house | 0.9907 | 0.9823 | 0.9619 | 0.9052 | 0.7828 | 0.5897 | 0.4097 | 0.4689 | 0.7464 | 0.9369 | 0.9833 | 0.9925 | | (89) |
| MIT 2 | 18.2984 | 18.5096 | 18.8565 | 19.3058 | 19.6639 | 19.8618 | 19.9103 | 19.9046 | 19.7712 | 19.3045 | 18.7250 | 18.2660 | | (90) |
| Living area fraction | | | | | | | | | | | | | | (91) |
| MIT | 18.5489 | 18.7602 | 19.1079 | 19.5592 | 19.9260 | 20.1346 | 20.1913 | 20.1827 | 20.0342 | 19.5551 | 18.9736 | 18.5149 | | (92) |
| Temperature adjustment | | | | | | | | | | | | | | (93) |
| adjusted MIT | 18.5489 | 18.7602 | 19.1079 | 19.5592 | 19.9260 | 20.1346 | 20.1913 | 20.1827 | 20.0342 | 19.5551 | 18.9736 | 18.5149 | | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|-----------|-------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Useful gains | 0.9876 | 0.9774 | 0.9546 | 0.8973 | 0.7834 | 0.6079 | 0.4401 | 0.4991 | 0.7548 | 0.9299 | 0.9788 | 0.9899 | (94) |
| Ext temp. | 375.1399 | 436.9504 | 492.1751 | 530.8160 | 506.7858 | 390.5493 | 269.0005 | 278.5058 | 376.3298 | 397.1768 | 366.4074 | 354.0675 | (95) |
| Heat loss rate W | 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) |
| Month fracti | 1127.0733 | 1093.9903 | 993.0650 | 831.3013 | 640.3443 | 427.0912 | 277.1319 | 291.4248 | 459.4738 | 697.0976 | 927.7689 | 1122.9250 | (97) |
| Space heating kWh | 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 | 559.4384 | 441.5308 | 372.6621 | 216.3494 | 99.3675 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 223.1411 | 404.1803 | 572.0300 | (98) |
| Space heating per m2 | | | | | | | | | | | | 2888.6986 | (98) |
| | | | | | | | | | | (98) / (4) = | | 44.8556 | (99) |

8c. Space cooling requirement

| | | | | | | | | | | | | | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|----------|---------|--------|--------|--------|
| Calculated for June, July and August. See Table 10b | | | | | | | | | | | | | |
| Ext. temp. | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Heat loss rate W | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8379 | 0.8951 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 607.7639 | 511.1198 | 507.0999 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 829.4115 | 791.3049 | 730.4446 | 0.0000 | 0.0000 | 0.0000 | (102) |
| 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 | (103) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 159.5862 | 208.4577 | 166.1684 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (103a) |
| | | | | | | | | | | | | | (104) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | |
|--|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------------------------|----------------|
| Space cooling | | | | | | | | | | | 534.2123 (104) |
| Cooled fraction | | | | | | | | | | FC - cooled area / (4) - | 1.0000 (105) |
| Intermittency factor (Table 10b) | | | | | | | | | | | |
| | 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 | 39.8966 | 52.1144 | 41.5421 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling | | | | | | | | | | | 133.5531 (107) |
| Space cooling per m2 | | | | | | | | | | | 2.0738 (108) |
| Energy for space heating | | | | | | | | | | | 44.8556 (99) |
| Energy for space cooling | | | | | | | | | | | 2.0738 (108) |
| Total | | | | | | | | | | | 46.9294 (109) |
| Dwelling Fabric Energy Efficiency (DFEE) | | | | | | | | | | | 46.9 (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.3775 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | | (21) = (18) x (20) = 0.3209 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 infiltr rate | 0.4092 | 0.4011 | 0.3931 | 0.3530 | 0.3450 | 0.3049 | 0.3049 | 0.2968 | 0.3209 | 0.3450 | 0.3610 | 0.3771 (22b) |
| Effective ac | 0.5837 | 0.5805 | 0.5773 | 0.5623 | 0.5595 | 0.5465 | 0.5465 | 0.5441 | 0.5515 | 0.5595 | 0.5652 | 0.5711 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|------------------------------|-----------------------------|---------------|-------------|-------------|-------------|-------------|------------------|
| TER Opaque door | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 11.2100 | 1.3258 | 14.8617 | | (27) | | | | | |
| 150mm B&B | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 78.2900 | 13.1800 | 65.1100 | 0.1800 | 11.7198 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1300 | 4.1860 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 142.6900 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 36.9235 | | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6496 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 45.5731 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2059 | Feb 30.0377 | Mar 29.8729 | Apr 29.0985 | May 28.9536 | Jun 28.2791 | Jul 28.2791 | Aug 28.1542 | Sep 28.5389 | Oct 28.9536 | Nov 29.2467 | Dec 29.5531 (38) |
| Heat transfer coeff | 75.7791 | 75.6109 | 75.4460 | 74.6716 | 74.5267 | 73.8523 | 73.8523 | 73.7273 | 74.1121 | 74.5267 | 74.8198 | 75.1263 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 74.6709 (39) |
| HLP | Jan 1.1767 | Feb 1.1741 | Mar 1.1715 | Apr 1.1595 | May 1.1572 | Jun 1.1468 | Jul 1.1468 | Aug 1.1448 | Sep 1.1508 | Oct 1.1572 | Nov 1.1618 | Dec 1.1666 (40) |
| HLP (average) | | | | | | | | | | | | 1.1595 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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 (46) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------|
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (57) |
| Heat gains from water heating, kWh/month | 0.0000 | 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) |
| | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.8378 | 14.9552 | 12.1624 | 9.2077 | 6.8829 | 5.8108 | 6.2788 | 8.1614 | 10.9542 | 13.9089 | 16.2337 | 17.3058 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) |
| Total internal gains | 294.4784 | 293.2618 | 283.0807 | 266.3819 | 248.8578 | 232.4345 | 222.0637 | 225.5295 | 234.3715 | 251.1930 | 270.5390 | 285.5955 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | | | |
|-------------|------------|--------------------------------|------------------------------|------------------------------|----------|------------------------------|------------|----------|----------|----------|----------|----------|------|
| Southeast | 3.4400 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 38.6817 | (77) | | | | | | |
| Southwest | 1.3200 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 14.8430 | (79) | | | | | | |
| Northwest | 6.4500 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 22.2410 | (81) | | | | | | |
| Solar gains | 75.7656 | 136.4444 | 206.3119 | 288.5210 | 353.1886 | 363.8398 | 345.2849 | 295.0212 | 234.4629 | 156.0909 | 92.0951 | 63.9690 | (83) |
| Total gains | 370.2440 | 429.7062 | 489.3926 | 554.9030 | 602.0464 | 596.2743 | 567.3487 | 520.5507 | 468.8344 | 407.2840 | 362.6341 | 349.5645 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | | 21.0000 (85) |
| tau | 59.0166 | 59.1479 | 59.2771 | 59.8919 | 60.0083 | 60.5563 | 60.5563 | 60.6589 | 60.3441 | 60.0083 | 59.7732 | 59.5294 | |
| alpha | 4.9344 | 4.9432 | 4.9518 | 4.9928 | 5.0006 | 5.0371 | 5.0371 | 5.0439 | 5.0229 | 5.0006 | 4.9849 | 4.9686 | |
| util living area | 0.9984 | 0.9962 | 0.9896 | 0.9642 | 0.8861 | 0.7251 | 0.5574 | 0.6232 | 0.8680 | 0.9806 | 0.9966 | 0.9988 | (86) |
| MIT | 19.6998 | 19.8540 | 20.1144 | 20.4636 | 20.7676 | 20.9412 | 20.9873 | 20.9785 | 20.8477 | 20.4528 | 20.0125 | 19.6726 | (87) |
| Th 2 | 19.9387 | 19.9408 | 19.9429 | 19.9525 | 19.9544 | 19.9628 | 19.9628 | 19.9644 | 19.9596 | 19.9544 | 19.9507 | 19.9468 | (88) |
| util rest of house | 0.9978 | 0.9949 | 0.9858 | 0.9502 | 0.8422 | 0.6332 | 0.4339 | 0.4968 | 0.8005 | 0.9705 | 0.9952 | 0.9983 | (89) |
| MIT 2 | 18.7549 | 18.9103 | 19.1704 | 19.5187 | 19.7969 | 19.9358 | 19.9596 | 19.9582 | 19.8736 | 19.5147 | 19.0767 | 18.7342 | (90) |
| Living area fraction | | | | | | | | | FLA = Living area / (4) = | | | 0.2661 | (91) |
| MIT | 19.0064 | 19.1615 | 19.4216 | 19.7702 | 20.0552 | 20.2034 | 20.2331 | 20.2298 | 20.1328 | 19.7644 | 19.3258 | 18.9840 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 19.0064 | 19.1615 | 19.4216 | 19.7702 | 20.0552 | 20.2034 | 20.2331 | 20.2298 | 20.1328 | 19.7644 | 19.3258 | 18.9840 | (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Utilisation | 0.9971 | 0.9936 | 0.9833 | 0.9472 | 0.8471 | 0.6561 | 0.4671 | 0.5308 | 0.8136 | 0.9681 | 0.9940 | 0.9978 | (94) |
| Useful gains | 369.1668 | 426.9579 | 481.2254 | 525.6197 | 509.9772 | 391.2184 | 265.0259 | 276.3039 | 381.4299 | 394.3065 | 360.4521 | 348.7967 | (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 | 1114.4401 | 1078.3231 | 974.8858 | 811.6929 | 622.6876 | 413.8232 | 268.3158 | 282.3601 | 447.1058 | 682.9925 | 914.7286 | 1110.6651 | (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | (97a) |
| Space heating kWh | 554.4833 | 437.7174 | 367.2834 | 205.9727 | 83.8565 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 214.7824 | 399.0791 | 566.8301 | (98) |
| Space heating | | | | | | | | | | | | 2830.0049 | (98) |
| Space heating per m2 | | | | | | | | | | | | 43.9442 | (99) |

8c. Space cooling requirement

| Calculated for June, July and August. See Table 10b | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|----------|--------|
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 694.2112 | 546.5067 | 560.3279 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8769 | 0.9324 | 0.9067 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 608.7328 | 509.5409 | 508.0642 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 775.4093 | 740.0566 | 686.6566 | 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 | 120.0070 | 171.5037 | 132.8728 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |
| Space cooling | | | | | | | | | | | | 424.3836 | (104) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------------------------|--------------|
| Cooled fraction | | | | | | | | | | | FC = cooled area / (4) = | 1.0000 (105) |
| Intermittency factor (Table 10b) | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2500 | 0.2500 | 0.2500 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (106) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 30.0018 | 42.8759 | 33.2182 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling | | | | | | | | | | | 106.0959 (107) | |
| Space cooling per m2 | | | | | | | | | | | 1.6475 (108) | |
| Energy for space heating | | | | | | | | | | | 43.9442 (99) | |
| Energy for space cooling | | | | | | | | | | | 1.6475 (108) | |
| Total | | | | | | | | | | | 45.5916 (109) | |
| Target Fabric Energy Efficiency (TFEE) | | | | | | | | | | | 52.4 (109) | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

| | | | | | |
|--|---|-----------------------|-------|-----------------------|------------|
| Property Reference | Brandon End-Terrace | | | Issued on Date | 15/10/2021 |
| Assessment Reference | 1 | Prop Type Ref | | | |
| Property | Plot 111, Chipping Lane , Longridge , PR3 | | | | |
| SAP Rating | 83 B | DER | 18.20 | TER | 19.00 |
| Environmental | 87 B | % DER<TER | 4.22 | | |
| CO₂ Emissions (t/year) | 1.06 | DFEE | 46.11 | TFEE | 50.20 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 8.15 | | |
| Assessor Details | Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk | | | Assessor ID | T759-0001 |
| Client | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 64 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) 19.00 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.20 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 46.1 kWh/m²/yrOK

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|----|
| External wall | 0.27 (max. 0.30) | 0.27 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.15 (max. 0.25) | 0.15 (max. 0.70) | OK |
| Roof | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.35 (max. 2.00) | 1.41 (max. 3.30) | OK |

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines (England)):Not significant OK

Based on:

Overshading:

Average

Windows facing South East: 6.45 m², No overhang

Windows facing South West: 1.32 m², No overhang

Windows facing North West: 3.44 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | 2.3100 (2b) | 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | 2.5600 (2c) | 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|--------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | 3 * 10 = | 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1913 (8) | | | | | | | |
| Pressure test | | | | Yes | | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.4418 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3755 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4788 | 0.4694 | 0.4600 | 0.4131 | 0.4037 | 0.3568 | 0.3568 | 0.3474 | 0.3755 | 0.4037 | 0.4225 | 0.4413 (22b) |
| Effective ac | 0.6146 | 0.6102 | 0.6058 | 0.5853 | 0.5815 | 0.5636 | 0.5636 | 0.5603 | 0.5705 | 0.5815 | 0.5892 | 0.5974 (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 (Uw = 1.41) | | | 11.2100 | 1.3347 | 14.9622 | | (27) | | | | | |
| Opening Type 9 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm TE Platinum GF | | | 32.2000 | 0.1500 | 4.8300 | | (28a) | | | | | |
| 50mm Alreflex Plat | 78.2900 | 13.1800 | 65.1100 | 0.2700 | 17.5797 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1100 | 3.5420 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 142.6900 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 42.8839 | (33) | | | | | |
| E-WM-20/22 | | | 37.2800 | 0.0000 | 0.0000 | | (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 176.5300 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.3138 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 50.1977 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 31.8063 | Feb 31.5759 | Mar 31.3501 | Apr 30.2896 | May 30.0912 | Jun 29.1676 | Jul 29.1676 | Aug 28.9965 | Sep 29.5233 | Oct 30.0912 | Nov 30.4926 | Dec 30.9122 (38) |
| Heat transfer coeff | 82.0040 | 81.7736 | 81.5478 | 80.4873 | 80.2889 | 79.3653 | 79.3653 | 79.1942 | 79.7210 | 80.2889 | 80.6903 | 81.1100 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 80.4864 (39) |
| HLP | Jan 1.2734 | Feb 1.2698 | Mar 1.2663 | Apr 1.2498 | May 1.2467 | Jun 1.2324 | Jul 1.2324 | Aug 1.2297 | Sep 1.2379 | Oct 1.2467 | Nov 1.2530 | Dec 1.2595 (40) |
| HLP (average) | | | | | | | | | | | | 1.2498 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| Assumed occupancy | 2.1029 (42) | | | | | | | | | | | |
|--|--------------|----------|----------|----------|----------|---------|---------|---------|---------|--------------------|----------|----------------|
| Average daily hot water use (litres/day) | 84.1444 (43) | | | | | | | | | | | |
| Daily hot water use | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Energy conte | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy content (annual) | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | Total = Sum(45)m = | | 1323.9193 (45) |
| Water storage loss: | 20.5893 | 18.0075 | 18.5822 | 16.2004 | 15.5447 | 13.4139 | 12.4299 | 14.2635 | 14.4339 | 16.8213 | 18.3617 | 19.9397 (46) |
| 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) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) | |
| Combi loss | 14.0615 | 12.6823 | 14.0117 | 13.5265 | 13.9533 | 13.4753 | 13.9072 | 13.9371 | 13.5032 | 13.9876 | 13.5748 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | (61) |
| Total heat required for water heating calculated for each month | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (63) |
| Output from w/h | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | (64) |
| Heat gains from water heating, kWh/month | 49.1550 | 43.0873 | 44.6934 | 39.2925 | 37.9457 | 33.1029 | 31.0298 | 35.1017 | 35.3709 | 40.7840 | 44.0956 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.8378 | 14.9552 | 12.1624 | 9.2077 | 6.8829 | 5.8108 | 6.2708 | 8.1614 | 10.9542 | 13.9089 | 16.2337 | 17.3058 |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 |
| 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 |
| Losses e.g. evaporation (negative values) (Table 5) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 |
| Water heating gains (Table 5) | 66.0686 | 64.1180 | 60.0718 | 54.5729 | 51.0022 | 45.9762 | 41.7067 | 47.1797 | 49.1262 | 54.8173 | 61.2438 | 64.1297 |
| Total internal gains | 324.3424 | 322.4174 | 310.7697 | 292.0791 | 273.2611 | 255.0177 | 243.1023 | 248.5498 | 258.0977 | 276.9806 | 298.6544 | 314.7577 |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | | |
|-------------|----------|--------------------------|---------------------------|---------------------------|----------|------------------------|----------|----------|----------|----------|----------|----------|
| Southeast | 6.4500 | 36.7938 | 0.7100 | | 0.7000 | 0.7700 | 81.7381 | | | | | |
| Southwest | 1.3200 | 36.7938 | 0.7100 | | 0.7000 | 0.7700 | 16.7278 | | | | | |
| Northwest | 3.4400 | 11.2829 | 0.7100 | | 0.7000 | 0.7700 | 13.3681 | | | | | |
| Solar gains | 111.8340 | 194.9350 | 278.5129 | 364.8602 | 426.7182 | 431.5695 | 412.7760 | 365.4137 | 308.2247 | 218.6248 | 134.7600 | 95.1833 |
| Total gains | 436.1764 | 517.3524 | 589.2827 | 656.9393 | 699.9793 | 686.5872 | 655.8783 | 613.9635 | 566.3225 | 495.6053 | 433.4144 | 409.9411 |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Thl (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 0.9884 | 0.9782 | 0.9568 | 0.9064 | 0.8082 | 0.6549 | 0.5061 | 0.5542 | 0.7730 | 0.9325 | 0.9799 | 0.9907 |
| tau | 38.5094 | 38.6179 | 38.7248 | 39.2351 | 39.3320 | 39.7898 | 39.7898 | 39.8757 | 39.6122 | 39.3320 | 39.1364 | 38.9339 |
| alpha | 3.5673 | 3.5745 | 3.5817 | 3.6157 | 3.6221 | 3.6527 | 3.6527 | 3.6584 | 3.6408 | 3.6221 | 3.6091 | 3.5956 |
| util living area | 0.9884 | 0.9782 | 0.9568 | 0.9064 | 0.8082 | 0.6549 | 0.5061 | 0.5542 | 0.7730 | 0.9325 | 0.9799 | 0.9907 |
| MIT | 19.2682 | 19.5029 | 19.8564 | 20.2977 | 20.6640 | 20.8914 | 20.9679 | 20.9551 | 20.7910 | 20.3076 | 19.7077 | 19.2289 |
| Th 2 | 19.8618 | 19.8646 | 19.8673 | 19.8804 | 19.8828 | 19.8942 | 19.8942 | 19.8963 | 19.8898 | 19.8828 | 19.8779 | 19.8727 |
| util rest of house | 0.9856 | 0.9729 | 0.9460 | 0.8822 | 0.7582 | 0.5680 | 0.3902 | 0.4372 | 0.6982 | 0.9099 | 0.9741 | 0.9884 |
| MIT 2 | 17.5742 | 17.9156 | 18.4253 | 19.0535 | 19.5393 | 19.8118 | 19.8791 | 19.8732 | 19.7095 | 19.0822 | 18.2242 | 17.5241 |
| Living area fraction | 18.0251 | 18.3381 | 18.8062 | 19.3847 | 19.8386 | 20.0991 | 20.1688 | 20.1611 | 19.9973 | 19.4083 | 18.6191 | 17.9778 |
| Temperature adjustment | 17.8751 | 18.1891 | 18.6562 | 19.2347 | 19.6886 | 19.9491 | 20.0188 | 20.0111 | 19.8473 | 19.2593 | 18.4691 | 17.8278 |
| adjusted MIT | 17.8751 | 18.1891 | 18.6562 | 19.2347 | 19.6886 | 19.9491 | 20.0188 | 20.0111 | 19.8473 | 19.2593 | 18.4691 | 17.8278 |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| Useful gains | 426.6666 | 497.5911 | 548.4159 | 568.2784 | 523.7105 | 393.1974 | 264.8998 | 276.3722 | 393.5624 | 442.7822 | 417.6449 | 402.5768 |
| Heat loss rate W | 1113.2090 | 1086.6125 | 991.3085 | 831.8093 | 641.3981 | 424.5337 | 271.3375 | 285.9822 | 458.1840 | 695.1684 | 917.3737 | 1105.3526 |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| Space heating kWh | 510.7875 | 395.8223 | 329.5121 | 189.7422 | 87.5595 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 187.7754 | 359.8047 | 522.8652 |
| Space heating | | | | | | | | | | | | 2583.8691 |
| Space heating per m2 | | | | | | | | | | | | 40.1222 |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| 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 | | | | | | | | | | | | | 2855.1039 (211) |
| Space heating requirement | 510.7875 | 395.8223 | 329.5121 | 189.7422 | 87.5595 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 187.7754 | 359.8047 | 522.8652 | (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) | 564.4061 | 437.3728 | 364.1018 | 209.6599 | 96.7509 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 207.4866 | 397.5742 | 577.7516 | (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 | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | (64) |
| Efficiency of water heater (217)m | 89.7481 | 89.6745 | 89.5318 | 89.2231 | 88.6377 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 89.1864 | 89.5992 | 89.7779 | (217) |
| Fuel for water heating, kWh/month | 168.6092 | 148.0159 | 154.0156 | 136.2082 | 132.6573 | 117.8706 | 110.8514 | 124.8879 | 125.6918 | 141.4222 | 151.7719 | 163.7183 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1675.7202 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2855.1039 (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) | | | | | | | | | | | | | 297.3610 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4903.1852 (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 | 2855.1039 | 0.2160 | 616.7025 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 1675.7202 | 0.2160 | 361.9556 | (264) |
| Space and water heating | | | 978.6580 | (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 | (267) |
| Energy for lighting | 297.3610 | 0.5190 | 154.3304 | (268) |
| Total CO2, kg/year | | | 1171.9134 | (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 18.2000 | (273) |

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

| | | | | |
|---|--|-----|---------|-----|
| DER | | | 18.2000 | ZC1 |
| Total Floor Area | | TFA | 64.4000 | |
| Assumed number of occupants | | N | 2.1029 | |
| CO2 emission factor in Table 12 for electricity displaced from grid | | EF | 0.5190 | |
| CO2 emissions from appliances, equation (L14) | | | 16.9209 | ZC2 |
| CO2 emissions from cooking, equation (L16) | | | 2.6315 | ZC3 |
| Total CO2 emissions | | | 37.7524 | 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 | | | 37.7524 | ZC8 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.3775 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3209 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4092 | 0.4011 | 0.3931 | 0.3530 | 0.3450 | 0.3049 | 0.3049 | 0.2968 | 0.3209 | 0.3450 | 0.3610 | 0.3771 (22b) |
| Effective ac | 0.5837 | 0.5805 | 0.5773 | 0.5623 | 0.5595 | 0.5465 | 0.5465 | 0.5441 | 0.5515 | 0.5595 | 0.5652 | 0.5711 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|---------------|-------------|-------------|-------------|-------------|------------------|
| TER Opaque door | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 11.2100 | 1.3258 | 14.8617 | | (27) | | | | | |
| 150mm TE Platinum GF | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 78.2900 | 13.1800 | 65.1100 | 0.1800 | 11.7198 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1300 | 4.1860 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 142.6900 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | | 36.9235 (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6496 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 45.5731 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2059 | Feb 30.0377 | Mar 29.8729 | Apr 29.0985 | May 28.9536 | Jun 28.2791 | Jul 28.2791 | Aug 28.1542 | Sep 28.5389 | Oct 28.9536 | Nov 29.2467 | Dec 29.5531 (38) |
| Heat transfer coeff | 75.7791 | 75.6109 | 75.4460 | 74.6716 | 74.5267 | 73.8523 | 73.8523 | 73.7273 | 74.1121 | 74.5267 | 74.8198 | 75.1263 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 74.6709 (39) |
| HLP | Jan 1.1767 | Feb 1.1741 | Mar 1.1715 | Apr 1.1595 | May 1.1572 | Jun 1.1468 | Jul 1.1468 | Aug 1.1448 | Sep 1.1508 | Oct 1.1572 | Nov 1.1618 | Dec 1.1666 (40) |
| HLP (average) | | | | | | | | | | | | 1.1595 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water storage loss: | 20.5893 | 18.0075 | 18.5822 | 16.2004 | 15.5447 | 13.4139 | 12.4299 | 14.2635 | 14.4339 | 16.8213 | 18.3617 | 19.9397 (46) |
| 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 | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Combi 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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) | |
| Total heat required for water heating calculated for each month | 47.1670 | 41.0533 | 43.7367 | 40.6660 | 40.3063 | 37.3463 | 38.5912 | 40.3063 | 40.6660 | 43.7367 | 43.9856 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | (61) |
| Solar input | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (62) |
| Output from w/h | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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) |
| Heat gains from water heating, kWh/month | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (64) |
| | 57.4314 | 50.1800 | 52.1247 | 46.0774 | 44.5339 | 39.0706 | 37.2008 | 41.6940 | 42.1615 | 48.2213 | 51.6983 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (66)m | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.8378 | 14.9552 | 12.1624 | 9.2077 | 6.8829 | 5.8108 | 6.2788 | 8.1614 | 10.9542 | 13.9089 | 16.2337 | 17.3058 | (67) | |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) | |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) | |
| Water heating gains (Table b) | 77.1927 | 74.6727 | 70.0600 | 63.9963 | 59.8574 | 54.2648 | 50.0010 | 56.0404 | 58.5577 | 64.8136 | 71.8031 | 75.2571 | (72) | |
| Total internal gains | 335.4665 | 332.9721 | 320.7580 | 301.5025 | 282.1163 | 263.3063 | 251.3967 | 257.4104 | 267.5292 | 286.9769 | 309.2137 | 325.8851 | (73) | |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 5a W/m2 | Specific data g or Table 5b | FF Specific data or Table 5c | Access factor Table 5d | Gains W | (77) | | | | | | |
|-------------|----------|--------------------------|-----------------------------|------------------------------|------------------------|----------|----------|----------|----------|----------|----------|----------|------|
| Southeast | 6.4500 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 72.5281 | (77) | | | | | | |
| Southwest | 1.3200 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 14.8430 | (79) | | | | | | |
| Northwest | 3.4400 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 11.8619 | (81) | | | | | | |
| Solar gains | 99.2330 | 172.9705 | 247.1312 | 323.7492 | 378.6372 | 382.9419 | 366.2660 | 324.2403 | 273.4952 | 193.9910 | 119.5757 | 84.4585 | (83) |
| Total gains | 434.6995 | 505.9426 | 567.8891 | 625.2517 | 660.7535 | 646.2482 | 617.6627 | 581.6507 | 541.0244 | 480.9679 | 428.7895 | 410.3436 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Thl (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (85) |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 59.0166 | 59.1479 | 59.2771 | 59.8919 | 60.0083 | 60.5563 | 60.5563 | 60.6589 | 60.3441 | 60.0083 | 59.7732 | 59.5294 | (85) |
| tau | 4.9344 | 4.9432 | 4.9518 | 4.9928 | 5.0006 | 5.0371 | 5.0371 | 5.0439 | 5.0229 | 5.0006 | 4.9849 | 4.9686 | (86) |
| util living area | 0.9966 | 0.9923 | 0.9809 | 0.9449 | 0.8526 | 0.6835 | 0.5161 | 0.5664 | 0.8096 | 0.9630 | 0.9929 | 0.9975 | (86) |
| MIT | 19.7921 | 19.9615 | 20.2201 | 20.5448 | 20.8111 | 20.9548 | 20.9910 | 20.9859 | 20.8930 | 20.5457 | 20.1061 | 19.7601 | (87) |
| Th 2 | 19.9387 | 19.9408 | 19.9429 | 19.9525 | 19.9544 | 19.9628 | 19.9628 | 19.9644 | 19.9596 | 19.9544 | 19.9507 | 19.9468 | (88) |
| util rest of house | 0.9955 | 0.9898 | 0.9743 | 0.9252 | 0.8022 | 0.5916 | 0.3996 | 0.4473 | 0.7311 | 0.9457 | 0.9900 | 0.9966 | (89) |
| MIT 2 | 18.3395 | 18.5873 | 18.9622 | 19.4263 | 19.7728 | 19.9335 | 19.9596 | 19.9587 | 19.8769 | 19.4375 | 18.8062 | 18.2985 | (90) |
| Living area fraction | 18.7261 | 18.9530 | 19.2970 | 19.7239 | 20.0491 | 20.2053 | 20.2341 | 20.2321 | 20.1473 | 19.7324 | 19.1522 | 18.6875 | (91) |
| MIT | 18.7261 | 18.9530 | 19.2970 | 19.7239 | 20.0491 | 20.2053 | 20.2341 | 20.2321 | 20.1473 | 19.7324 | 19.1522 | 18.6875 | (92) |
| Temperature adjustment | 18.7261 | 18.9530 | 19.2970 | 19.7239 | 20.0491 | 20.2053 | 20.2341 | 20.2321 | 20.1473 | 19.7324 | 19.1522 | 18.6875 | (93) |
| adjusted MIT | 18.7261 | 18.9530 | 19.2970 | 19.7239 | 20.0491 | 20.2053 | 20.2341 | 20.2321 | 20.1473 | 19.7324 | 19.1522 | 18.6875 | (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (94) |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Useful gains | 431.9225 | 499.0930 | 550.2483 | 575.2146 | 533.4658 | 397.0294 | 266.0910 | 278.6761 | 404.1337 | 452.5741 | 423.1948 | 408.3298 | (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 | 1093.1990 | 1062.5605 | 965.4800 | 808.2417 | 622.2343 | 413.9645 | 268.3852 | 282.5314 | 448.1806 | 680.6115 | 901.7420 | 1088.3910 | (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 | 491.9897 | 378.6502 | 308.9324 | 167.7795 | 66.0438 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 169.6598 | 344.5540 | 505.9655 | (98) |
| Space heating | | | | | | | | | | | | 2433.5750 | (98) |
| Space heating per m2 | | | | | | | | | | | | 37.7884 | (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 %) | | | | | | | | | | | | | 93.4000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2605.5407 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 491.9897 | 378.6502 | 308.9324 | 167.7795 | 66.0438 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 169.6598 | 344.5540 | 505.9655 | (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) | 526.7556 | 405.4070 | 330.7627 | 179.6355 | 70.7107 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 181.6487 | 368.9015 | 541.7190 | (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 | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | (64) |
| Efficiency of water heater (217)m | 87.4026 | 87.1290 | 86.5701 | 85.3562 | 83.2245 | 80.3000 | 80.3000 | 80.3000 | 80.3000 | 85.2648 | 86.8428 | 87.5106 | (216) |
| Fuel for water heating, kWh/month | 211.0110 | 184.9023 | 193.6209 | 174.1743 | 172.9507 | 157.8730 | 151.2544 | 168.6132 | 170.4753 | 182.8170 | 191.6073 | 205.8014 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2165.1008 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2605.5407 (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) | | | | | | | | | | | | | 297.3610 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5143.0025 (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 | 2605.5407 | 0.2160 | 562.7968 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 2165.1008 | 0.2160 | 467.6618 (264) |
| Space and water heating | | | 1030.4586 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 297.3610 | 0.5190 | 154.3304 (268) |
| Total CO2, kg/m2/year | | | 1223.7139 (272) |
| Emissions per m2 for space and water heating | | | 16.0009 (272a) |
| Fuel factor (mains gas) | | | 1.0000 |
| Emissions per m2 for lighting | | | 2.3964 (272b) |
| Emissions per m2 for pumps and fans | | | 0.6044 (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (16.0009 * 1.00) + 2.3964 + 0.6044, rounded to 2 d.p. | | | 19.0000 (273) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-------|-----------------------------|----------------------------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) |
| Number of open flues | 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) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0100 |
| Infiltration rate | | | | | 0.3780 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | | | (21) = (18) x (20) = 0.3213 (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 | 0.4097 | 0.4017 | 0.3936 | 0.3535 | 0.3454 | 0.3053 | 0.3053 | 0.2972 | 0.3213 | 0.3454 | 0.3615 | 0.3776 (22b) |
| Effective ac | 0.5839 | 0.5807 | 0.5775 | 0.5625 | 0.5597 | 0.5466 | 0.5466 | 0.5442 | 0.5516 | 0.5597 | 0.5653 | 0.5713 (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 (Uw = 1.41) | | | 11.2100 | 1.3347 | 14.9622 | | (27) |
| Opening Type 9 | | | 1.9700 | 1.0000 | 1.9700 | | (26) |
| 150mm TE Platinum GF | | | 32.2000 | 0.1500 | 4.8300 | | (28a) |
| 50mm Alreflex Plat | 78.2900 | 13.1800 | 65.1100 | 0.2700 | 17.5797 | | (29a) |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1100 | 3.5420 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 142.6900 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 42.8839 | | (33) |
| E-WM-20/22 | | | 37.2800 | 0.0000 | 0.0000 | | (32) |

| | | | | | | | |
|--|--|--|--|--|--|---------------|---------------|
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 176.5300 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.3138 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 50.1977 (37) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | 30.2174 | 30.0488 | 29.8835 | 29.1070 | 28.9617 | 28.2855 | 28.2855 | 28.1602 | 28.5460 | 28.9617 | 29.2556 | 29.5629 (38) |
| Heat transfer coeff | 80.4151 | 80.2465 | 80.0812 | 79.3047 | 79.1595 | 78.4832 | 78.4832 | 78.3580 | 78.7437 | 79.1595 | 79.4533 | 79.7606 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 79.3040 (39) |
| HLP | 1.2487 | 1.2461 | 1.2435 | 1.2314 | 1.2292 | 1.2187 | 1.2187 | 1.2167 | 1.2227 | 1.2292 | 1.2337 | 1.2385 (40) |
| HLP (average) | | | | | | | | | | | | 1.2314 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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 | 0.0000 (59) |
| Heat gains from water heating, kWh/month | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | (65) |

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | | |
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.8378 | 14.9552 | 12.1624 | 9.2077 | 6.8829 | 5.8108 | 6.2788 | 8.1614 | 10.9542 | 13.9089 | 16.2337 | 17.3058 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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 c.g. evaporation (negative values) (Table 5) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) |
| Total internal gains | 294.4784 | 293.2618 | 283.0807 | 266.3819 | 248.8578 | 232.4345 | 222.0637 | 225.5295 | 234.3715 | 251.1930 | 270.5390 | 285.5955 | (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 | | 6.4500 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 81.7381 (77) | | | | | | |
| Southwest | | 1.3200 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 16.7278 (79) | | | | | | |
| Northwest | | 3.4400 | 11.2829 | 0.7100 | 0.7000 | 0.7700 | 13.3681 (81) | | | | | | |
| Solar gains | 111.8340 | 194.9350 | 278.5129 | 364.8602 | 426.7182 | 431.5695 | 412.7760 | 365.4137 | 308.2247 | 218.6248 | 134.7600 | 95.1833 | (83) |
| Total gains | 406.3124 | 488.1967 | 561.5936 | 631.2421 | 675.5760 | 664.0040 | 634.8397 | 590.9432 | 542.5962 | 469.8178 | 405.2990 | 380.7788 | (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nll,m (see Table 9a) | | | | | | | | | | | | | |
| tau | 39.2703 | 39.3528 | 39.4341 | 39.8201 | 39.8932 | 40.2370 | 40.2370 | 40.3013 | 40.1039 | 39.8932 | 39.7457 | 39.5926 | 39.5926 |
| alpha | 3.6180 | 3.6235 | 3.6289 | 3.6547 | 3.6595 | 3.6825 | 3.6825 | 3.6868 | 3.6736 | 3.6595 | 3.6497 | 3.6395 | 3.6395 |
| util living area | 0.9907 | 0.9815 | 0.9617 | 0.9137 | 0.8178 | 0.6661 | 0.5160 | 0.5673 | 0.7866 | 0.9405 | 0.9835 | 0.9926 | (86) |
| MIT | 19.2545 | 19.4904 | 19.8457 | 20.2865 | 20.6574 | 20.8878 | 20.9668 | 20.9529 | 20.7824 | 20.2889 | 19.6854 | 19.2101 | (87) |
| Th 2 | 19.8813 | 19.8833 | 19.8854 | 19.8949 | 19.8967 | 19.9051 | 19.9051 | 19.9066 | 19.9019 | 19.8967 | 19.8931 | 19.8893 | (88) |
| util rest of house | 0.9884 | 0.9770 | 0.9520 | 0.8910 | 0.7693 | 0.5798 | 0.3995 | 0.4498 | 0.7139 | 0.9202 | 0.9787 | 0.9908 | (89) |
| MIT 2 | 18.3010 | 18.5360 | 18.8869 | 19.3181 | 19.6559 | 19.8465 | 19.8943 | 19.8898 | 19.7721 | 19.3306 | 18.7387 | 18.2630 | (90) |
| Living area fraction | | | | | | | | | FLA = Living area / (4) = | | | | 0.2661 (91) |
| MIT | 18.5547 | 18.7900 | 19.1421 | 19.5758 | 19.9225 | 20.1236 | 20.1797 | 20.1728 | 20.0410 | 19.5856 | 18.9906 | 18.5150 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 18.5547 | 18.7900 | 19.1421 | 19.5758 | 19.9225 | 20.1236 | 20.1797 | 20.1728 | 20.0410 | 19.5856 | 18.9906 | 18.5150 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|--------------|
| Utilisation | 0.9847 | 0.9711 | 0.9439 | 0.8832 | 0.7705 | 0.5983 | 0.4300 | 0.4800 | 0.7243 | 0.9130 | 0.9735 | 0.9877 | (94) |
| Useful gains | 400.1076 | 474.1090 | 530.0673 | 557.5218 | 520.5523 | 397.2868 | 272.9927 | 283.6655 | 393.0208 | 428.9372 | 394.5452 | 376.0860 | (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 | 1146.2973 | 1114.6249 | 1012.3912 | 846.6446 | 650.8852 | 433.5107 | 280.9501 | 295.6258 | 467.8156 | 711.2979 | 944.7510 | 1141.7758 | (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 | 555.1651 | 430.4267 | 358.8490 | 208.1684 | 96.9677 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 210.0763 | 396.1482 | 569.6732 | (98) |
| Space heating | | | | | | | | | | | | 2825.4746 | (98) |
| Space heating per m2 | | | | | | | | | | | | (98) / (4) = | 43.8738 (99) |

8c. Space cooling requirement

| | | | | | | | | | | | | | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------|--------|
| Calculated for June, July and August. See Table 10b | | | | | | | | | | | | | |
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 737.7420 | 580.7756 | 595.5205 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8401 | 0.8974 | 0.8741 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 619.7843 | 521.2106 | 520.5401 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 854.5739 | 818.9423 | 768.9336 | 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 | 169.0485 | 221.5123 | 184.8047 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | |
|--|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------------------------|----------------|
| Space cooling | | | | | | | | | | | 575.3656 (104) |
| Cooled fraction | | | | | | | | | | FC - cooled area / (4) - | 1.0000 (105) |
| Intermittency factor (Table 10b) | 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 | 42.2621 | 55.3781 | 46.2012 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling | | | | | | | | | | | 143.8414 (107) |
| Space cooling per m2 | | | | | | | | | | | 2.2336 (108) |
| Energy for space heating | | | | | | | | | | | 43.8738 (99) |
| Energy for space cooling | | | | | | | | | | | 2.2336 (108) |
| Total | | | | | | | | | | | 46.1074 (109) |
| Dwelling Fabric Energy Efficiency (DFEE) | | | | | | | | | | | 46.1 (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.3775 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | | (21) = (18) x (20) = 0.3209 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4092 | 0.4011 | 0.3931 | 0.3530 | 0.3450 | 0.3049 | 0.3049 | 0.2968 | 0.3209 | 0.3450 | 0.3610 | 0.3771 (22b) |
| Effective ac | 0.5837 | 0.5805 | 0.5773 | 0.5623 | 0.5595 | 0.5465 | 0.5465 | 0.5441 | 0.5515 | 0.5595 | 0.5652 | 0.5711 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|------------------------------|-----------------------------|----------------------------|-------------|-------------|-------------|-------------|------------------|
| TER Opaque door | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 11.2100 | 1.3258 | 14.8617 | | (27) | | | | | |
| 150mm TE Platinum GF | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 78.2900 | 13.1800 | 65.1100 | 0.1800 | 11.7198 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1300 | 4.1860 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 142.6900 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 36.9235 | | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6496 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 45.5731 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2059 | Feb 30.0377 | Mar 29.8729 | Apr 29.0985 | May 28.9536 | Jun 28.2791 | Jul 28.2791 | Aug 28.1542 | Sep 28.5389 | Oct 28.9536 | Nov 29.2467 | Dec 29.5531 (38) |
| Heat transfer coeff | 75.7791 | 75.6109 | 75.4460 | 74.6716 | 74.5267 | 73.8523 | 73.8523 | 73.7273 | 74.1121 | 74.5267 | 74.8198 | 75.1263 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 74.6709 (39) |
| HLP | Jan 1.1767 | Feb 1.1741 | Mar 1.1715 | Apr 1.1595 | May 1.1572 | Jun 1.1468 | Jul 1.1468 | Aug 1.1448 | Sep 1.1508 | Oct 1.1572 | Nov 1.1618 | Dec 1.1666 (40) |
| HLP (average) | | | | | | | | | | | | 1.1595 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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 (46) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------|
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (57) |
| Heat gains from water heating, kWh/month | 0.0000 | 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) |
| | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 16.8378 | 14.9552 | 12.1624 | 9.2077 | 6.8829 | 5.8108 | 6.2788 | 8.1614 | 10.9542 | 13.9089 | 16.2337 | 17.3058 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) |
| Total internal gains | 294.4784 | 293.2618 | 283.0807 | 266.3819 | 248.8578 | 232.4345 | 222.0637 | 225.5295 | 234.3715 | 251.1930 | 270.5390 | 285.5955 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | | |
|-------------|----------|--------------------------|---------------------------|---------------------------|----------|------------------------|----------|----------|----------|----------|----------|---------------|
| Southeast | 6.4500 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 72.5281 (77) | | | | | | |
| Southwest | 1.3200 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 14.8430 (79) | | | | | | |
| Northwest | 3.4400 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 11.8619 (81) | | | | | | |
| Solar gains | 99.2330 | 172.9705 | 247.1312 | 323.7492 | 378.6372 | 382.9419 | 366.2660 | 324.2403 | 273.4952 | 193.9910 | 119.5757 | 84.4585 (83) |
| Total gains | 393.7113 | 466.2322 | 530.2118 | 590.1311 | 627.4950 | 615.3764 | 588.3297 | 549.7698 | 507.8667 | 445.1840 | 390.1148 | 370.0540 (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Thl (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 59.0166 | 59.1479 | 59.2771 | 59.8919 | 60.0083 | 60.5563 | 60.5563 | 60.6589 | 60.3441 | 60.0083 | 59.7732 | 59.5294 | 21.0000 (85) |
| tau | 4.9344 | 4.9432 | 4.9518 | 4.9928 | 5.0006 | 5.0371 | 5.0371 | 5.0439 | 5.0229 | 5.0006 | 4.9849 | 4.9686 | |
| alpha | 0.9978 | 0.9946 | 0.9855 | 0.9552 | 0.8719 | 0.7089 | 0.5395 | 0.5950 | 0.8368 | 0.9724 | 0.9953 | 0.9984 (86) | |
| util living area | 19.7335 | 19.9058 | 20.1699 | 20.5052 | 20.7874 | 20.9469 | 20.9890 | 20.9825 | 20.8741 | 20.5017 | 20.0516 | 19.7021 (87) | |
| MIT | 19.9387 | 19.9408 | 19.9429 | 19.9525 | 19.9544 | 19.9628 | 19.9628 | 19.9644 | 19.9596 | 19.9544 | 19.9507 | 19.9468 (88) | |
| Th 2 | 0.9971 | 0.9928 | 0.9804 | 0.9383 | 0.8250 | 0.6168 | 0.4189 | 0.4719 | 0.7626 | 0.9588 | 0.9933 | 0.9979 (89) | |
| util rest of house | 18.7885 | 18.9616 | 19.2247 | 19.5572 | 19.8124 | 19.9388 | 19.9601 | 19.9595 | 19.8911 | 19.5607 | 19.1154 | 18.7637 (90) | |
| MIT 2 | 19.0400 | 19.2129 | 19.4762 | 19.8095 | 20.0719 | 20.2071 | 20.2339 | 20.2318 | 20.1527 | 19.8111 | 19.3646 | 19.0135 (92) | |
| Living area fraction | 19.0400 | 19.2129 | 19.4762 | 19.8095 | 20.0719 | 20.2071 | 20.2339 | 20.2318 | 20.1527 | 19.8111 | 19.3646 | 19.0135 (92) | |
| MIT | 19.0400 | 19.2129 | 19.4762 | 19.8095 | 20.0719 | 20.2071 | 20.2339 | 20.2318 | 20.1527 | 19.8111 | 19.3646 | 19.0135 (93) | |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 19.0400 | 19.2129 | 19.4762 | 19.8095 | 20.0719 | 20.2071 | 20.2339 | 20.2318 | 20.1527 | 19.8111 | 19.3646 | 19.0135 (93) | |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|--|
| Utilisation | 0.9962 | 0.9911 | 0.9774 | 0.9356 | 0.8310 | 0.6400 | 0.4514 | 0.5050 | 0.7783 | 0.9565 | 0.9919 | 0.9972 (94) | |
| Useful gains | 392.2231 | 462.0731 | 518.2360 | 552.1024 | 521.4255 | 393.8246 | 265.5495 | 277.6395 | 395.2643 | 425.7982 | 386.9409 | 369.0131 (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 | 1116.9873 | 1082.2115 | 979.0055 | 814.6310 | 623.9269 | 414.0942 | 268.3742 | 282.5052 | 448.5786 | 686.4760 | 917.6359 | 1112.8813 (97) | |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 (97a) | |
| Space heating kWh | 539.2246 | 416.7330 | 342.8125 | 189.0206 | 76.2610 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 193.9443 | 382.1004 | 553.4380 (98) | |
| Space heating | | | | | | | | | | | | 2693.5344 (98) | |
| Space heating per m2 | | | | | | | | | | | | 41.8251 (99) | |

8c. Space cooling requirement

| Calculated for June, July and August. See Table 10b | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------|----------------|
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 694.2112 | 546.5067 | 560.3279 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8865 | 0.9395 | 0.9200 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 615.4512 | 513.4267 | 515.5281 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 797.7365 | 764.5800 | 720.8089 | 0.0000 | 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 | 0.0000 (103a) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 131.2454 | 186.8580 | 152.7289 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (104) |
| Space cooling | | | | | | | | | | | | | 470.8323 (104) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------------------------|--------------|
| Cooled fraction | | | | | | | | | | | FC = cooled area / (4) = | 1.0000 (105) |
| Intermittency factor (Table 10b) | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2500 | 0.2500 | 0.2500 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (106) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 32.8113 | 46.7145 | 38.1822 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling | | | | | | | | | | | 117.7081 (107) | |
| Space cooling per m2 | | | | | | | | | | | 1.8278 (108) | |
| Energy for space heating | | | | | | | | | | | 41.8251 (99) | |
| Energy for space cooling | | | | | | | | | | | 1.8278 (108) | |
| Total | | | | | | | | | | | 43.6528 (109) | |
| Target Fabric Energy Efficiency (TFEE) | | | | | | | | | | | 50.2 (109) | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

| | | | | | |
|--|---|-----------------------|-------|-----------------------|------------|
| Property Reference | Brandon Mid-Terrace | | | Issued on Date | 15/10/2021 |
| Assessment Reference | 1 | Prop Type Ref | | | |
| Property | Plot 112, Chipping Lane , Longridge , PR3 | | | | |
| SAP Rating | 84 B | DER | 16.40 | TER | 17.67 |
| Environmental | 88 B | % DER<TER | 7.18 | | |
| CO₂ Emissions (t/year) | 0.94 | DFEE | 37.32 | TFEE | 42.74 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 12.67 | | |
| Assessor Details | Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk | | | Assessor ID | T759-0001 |
| Client | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 64 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) 17.67 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.40 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 42.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 37.3 kWh/m²/yrOK

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|----|
| External wall | 0.27 (max. 0.30) | 0.27 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.34 (max. 2.00) | 1.41 (max. 3.30) | OK |

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

OK

Minimum: 88.0%

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines (England)): Not significant

OK

Based on:

Overshading:

Average

Windows facing South East:

6.45 m², No overhang

Windows facing North West:

3.44 m², No overhang

Air change rate:

4.00 ach

Blinds/curtains:

Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | + | 0 | = | 0 * 20 = 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | | 3 * 10 = 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | | 0 * 10 = 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | | 0 * 40 = 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 30.0000 / (5) = 0.1913 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.4418 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | | (21) = (18) x (20) = 0.3755 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4788 | 0.4694 | 0.4600 | 0.4131 | 0.4037 | 0.3568 | 0.3568 | 0.3474 | 0.3755 | 0.4037 | 0.4225 | 0.4413 (22b) |
| Effective ac | 0.6146 | 0.6102 | 0.6058 | 0.5853 | 0.5815 | 0.5636 | 0.5636 | 0.5603 | 0.5705 | 0.5815 | 0.5892 | 0.5974 (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 (Uw = 1.41) | | | 9.8900 | 1.3347 | 13.2004 | | (27) | | | | | |
| Opening Type 7 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm TE Platinum GF | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.2700 | 7.8705 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1100 | 3.5420 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 30.7689 | | (33) | | | | | |
| E-WM-20/22 | | | 74.5600 | 0.0000 | 0.0000 | | (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 192.6000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.1597 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 37.9286 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 31.8063 | Feb 31.5759 | Mar 31.3501 | Apr 30.2896 | May 30.0912 | Jun 29.1676 | Jul 29.1676 | Aug 28.9965 | Sep 29.5233 | Oct 30.0912 | Nov 30.4926 | Dec 30.9122 (38) |
| Heat transfer coeff | 69.7349 | 69.5045 | 69.2787 | 68.2182 | 68.0198 | 67.0962 | 67.0962 | 66.9251 | 67.4520 | 68.0198 | 68.4212 | 68.8409 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 68.2173 (39) |
| HLP | Jan 1.0828 | Feb 1.0793 | Mar 1.0758 | Apr 1.0593 | May 1.0562 | Jun 1.0419 | Jul 1.0419 | Aug 1.0392 | Sep 1.0474 | Oct 1.0562 | Nov 1.0624 | Dec 1.0690 (40) |
| HLP (average) | | | | | | | | | | | | 1.0593 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 20.5893 | 18.0075 | 18.5822 | 16.2004 | 15.5447 | 13.4139 | 12.4299 | 14.2635 | 14.4339 | 16.8213 | 18.3617 | 19.9397 (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) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) | |
| Combi loss | 14.0615 | 12.6823 | 14.0117 | 13.5265 | 13.9533 | 13.4753 | 13.9072 | 13.9371 | 13.5032 | 13.9876 | 13.5748 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | 14.0519 | (61) |
| Total heat required for water heating calculated for each month | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (63) |
| Output from w/h | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | 146.9829 | (64) |
| Heat gains from water heating, kWh/month | 49.1550 | 43.0873 | 44.6934 | 39.2925 | 37.9457 | 33.1029 | 31.0298 | 35.1017 | 35.3709 | 40.7840 | 44.0956 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | 47.7125 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 66.0686 | 64.1180 | 60.0718 | 54.5729 | 51.0022 | 45.9762 | 41.7067 | 47.1797 | 49.1262 | 54.8173 | 61.2438 | 64.1297 | (72) |
| Total internal gains | 324.7503 | 322.7797 | 311.0644 | 292.3021 | 273.4278 | 255.1585 | 243.2544 | 248.7475 | 258.3631 | 277.3175 | 299.0477 | 315.1769 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | α Specific data or Table 6c | FF Specific data or Table 6c | Access factor Table 6d | Gains W | | | | | | |
|-------------|------------|--------------------------------|------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|----------|----------|----------|----------|----------|------|
| Southeast | 6.4500 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 81.7381 | (77) | | | | | | |
| Northwest | 3.4400 | 11.2829 | 0.7100 | 0.7000 | 0.7700 | 13.3681 | (81) | | | | | | |
| Solar gains | 95.1062 | 166.4414 | 239.5267 | 316.5544 | 372.6116 | 377.8542 | 360.9887 | 317.9540 | 266.0109 | 187.1332 | 114.7239 | 80.8678 | (83) |
| Total gains | 419.8564 | 489.2211 | 550.5911 | 608.8565 | 646.0395 | 633.0127 | 604.2432 | 566.7015 | 524.3740 | 464.4507 | 413.7716 | 396.0448 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, T _{hi} (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, n _{il,m} (see Table 9a) | 49.4071 | 49.5709 | 49.7324 | 50.5055 | 50.6529 | 51.3502 | 51.3502 | 51.4814 | 51.0793 | 50.6529 | 50.3557 | 50.0488 | 21.0000 (85) |
| util living area | 4.2938 | 4.3047 | 4.3155 | 4.3670 | 4.3769 | 4.4233 | 4.4233 | 4.4321 | 4.4053 | 4.3769 | 4.3570 | 4.3366 | |
| MIT | 0.9920 | 0.9838 | 0.9648 | 0.9137 | 0.8054 | 0.6337 | 0.4778 | 0.5260 | 0.7634 | 0.9392 | 0.9848 | 0.9937 | (86) |
| MIT 2 | 19.6469 | 19.8456 | 20.1425 | 20.5106 | 20.7957 | 20.9484 | 20.9882 | 20.9822 | 20.8813 | 20.5065 | 20.0123 | 19.6156 | (87) |
| Th 2 | 20.0149 | 20.0178 | 20.0207 | 20.0342 | 20.0368 | 20.0486 | 20.0486 | 20.0508 | 20.0440 | 20.0368 | 20.0316 | 20.0263 | (88) |
| util rest of house | 0.9899 | 0.9798 | 0.9558 | 0.8913 | 0.7574 | 0.5549 | 0.3795 | 0.4252 | 0.6925 | 0.9186 | 0.9803 | 0.9921 | (89) |
| MIT 2 | 18.2128 | 18.5027 | 18.9316 | 19.4566 | 19.8296 | 20.0102 | 20.0431 | 20.0418 | 19.9431 | 19.4631 | 18.7563 | 18.1751 | (90) |
| Living area fraction | 18.5944 | 18.8601 | 19.2538 | 19.7371 | 20.0867 | 20.2599 | 20.2946 | 20.2920 | 20.1928 | 19.7408 | 19.0905 | 18.5585 | (92) |
| Temperature adjustment | 18.4444 | 18.7101 | 19.1038 | 19.5871 | 19.9367 | 20.1099 | 20.1446 | 20.1420 | 20.0428 | 19.5908 | 18.9405 | 18.4085 | (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|-----------|-------|
| Useful gains | 0.9852 | 0.9723 | 0.9417 | 0.8789 | 0.7519 | 0.5602 | 0.3897 | 0.4352 | 0.6924 | 0.9066 | 0.9731 | 0.9881 | (94) |
| Ext temp. | 413.6293 | 475.6596 | 520.1657 | 535.1125 | 485.7404 | 354.6314 | 235.4831 | 246.6465 | 363.0942 | 421.0633 | 402.6300 | 391.3341 | (95) |
| Heat loss rate W | 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) |
| Month fracti | 986.3613 | 959.8670 | 873.1787 | 729.0556 | 560.2584 | 369.6944 | 237.8305 | 250.4370 | 400.8535 | 611.5551 | 810.1447 | 978.1224 | (97) |
| Space heating kWh | 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 | 426.1126 | 325.3874 | 262.6417 | 139.6390 | 55.4414 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 141.7259 | 293.4106 | 436.5704 | (98) |
| Space heating per m2 | | | | | | | | | | | | 2080.9290 | (98) |
| | | | | | | | | | | (98) / (4) = | | 32.3126 | (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 | | | | | | | | | | | | | 2299.3690 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 426.1126 | 325.3874 | 262.6417 | 139.6390 | 55.4414 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 141.7259 | 293.4106 | 436.5704 | (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) | 470.8427 | 359.5441 | 290.2118 | 154.2973 | 61.2612 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 156.6032 | 324.2106 | 482.3983 | (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 | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | (64) |
| Efficiency of water heater (217)m | 89.6389 | 89.5490 | 89.3722 | 88.9823 | 88.3004 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 88.9644 | 89.4615 | 87.3000 | (216) |
| Fuel for water heating, kWh/month | 168.8146 | 148.2235 | 154.2906 | 136.5768 | 133.1640 | 117.8706 | 110.8514 | 124.8879 | 125.6918 | 141.7750 | 152.0055 | 163.9115 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1678.0633 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2299.3690 (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) | | | | | | | | | | | | | 304.5642 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4356.9965 (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 | 2299.3690 | 0.2160 | 496.6637 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1678.0633 | 0.2160 | 362.4617 (264) |
| Space and water heating | | | 859.1254 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 304.5642 | 0.5190 | 158.0688 (268) |
| Total CO2, kg/year | | | 1056.1192 (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 16.4000 (273) |

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

| | TFA | N | EF | |
|---|-----|---|----|-------------|
| DER | | | | 16.4000 ZC1 |
| Total Floor Area | | | | 64.4000 |
| Assumed number of occupants | | | | 2.1029 |
| CO2 emission factor in Table 12 for electricity displaced from grid | | | | 0.5190 |
| CO2 emissions from appliances, equation (L14) | | | | 16.9209 ZC2 |
| CO2 emissions from cooking, equation (L16) | | | | 2.6315 ZC3 |
| Total CO2 emissions | | | | 35.9524 ZC4 |
| Residual CO2 emissions offset from biofuel CHP | | | | 0.0000 ZC5 |
| Additional allowable electricity generation, kWh/m ² /year | | | | 0.0000 ZC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation | | | | 0.0000 ZC7 |
| Net CO2 emissions | | | | 35.9524 ZC8 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.3775 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3209 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4092 | 0.4011 | 0.3931 | 0.3530 | 0.3450 | 0.3049 | 0.3049 | 0.2968 | 0.3209 | 0.3450 | 0.3610 | 0.3771 (22b) |
| Effective ac | 0.5837 | 0.5805 | 0.5773 | 0.5623 | 0.5595 | 0.5465 | 0.5465 | 0.5441 | 0.5515 | 0.5595 | 0.5652 | 0.5711 (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 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 9.8900 | 1.3258 | 13.1117 | | (27) | | | | | |
| 150mm TE Platinum GF | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.1800 | 5.2470 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1300 | 4.1860 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 28.7007 | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.8662 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 36.5669 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2059 | Feb 30.0377 | Mar 29.8729 | Apr 29.0985 | May 28.9536 | Jun 28.2791 | Jul 28.2791 | Aug 28.1542 | Sep 28.5389 | Oct 28.9536 | Nov 29.2467 | Dec 29.5531 (38) |
| Heat transfer coeff | 66.7729 | 66.6047 | 66.4398 | 65.6654 | 65.5205 | 64.8461 | 64.8461 | 64.7211 | 65.1059 | 65.5205 | 65.8136 | 66.1201 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 65.6647 (39) |
| HLP | Jan 1.0368 | Feb 1.0342 | Mar 1.0317 | Apr 1.0196 | May 1.0174 | Jun 1.0069 | Jul 1.0069 | Aug 1.0050 | Sep 1.0110 | Oct 1.0174 | Nov 1.0220 | Dec 1.0267 (40) |
| HLP (average) | | | | | | | | | | | | 1.0196 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water storage loss: | 20.5893 | 18.0075 | 18.5822 | 16.2004 | 15.5447 | 13.4139 | 12.4299 | 14.2635 | 14.4339 | 16.8213 | 18.3617 | 19.9397 (46) |
| 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 | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Combi 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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) | |
| Total heat required for water heating calculated for each month | 47.1670 | 41.0533 | 43.7367 | 40.6660 | 40.3063 | 37.3463 | 38.5912 | 40.3063 | 40.6660 | 43.7367 | 43.9856 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | (61) |
| Solar input | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (62) |
| Output from w/h | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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) |
| Heat gains from water heating, kWh/month | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (64) |
| | 57.4314 | 50.1800 | 52.1247 | 46.0774 | 44.5339 | 39.0706 | 37.2008 | 41.6940 | 42.1615 | 48.2213 | 51.6983 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (66) |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table b) | 77.1927 | 74.6727 | 70.0600 | 63.9963 | 59.8574 | 54.2648 | 50.0010 | 56.0404 | 58.5577 | 64.8136 | 71.8031 | 75.2571 | (72) |
| Total internal gains | 335.8744 | 333.3344 | 321.0526 | 301.7256 | 282.2830 | 263.4470 | 251.5488 | 257.6081 | 267.7946 | 287.3138 | 309.6070 | 326.3043 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 5a W/m2 | Specific data or Table 5b | FF Specific data or Table 5c | Access factor Table 5d | Gains W | (77) | | | | | | |
|-------------|----------|--------------------------|---------------------------|------------------------------|------------------------|----------|----------|----------|----------|----------|----------|----------|------|
| Southeast | 6.4500 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 72.5281 | (77) | | | | | | |
| Northwest | 3.4400 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 11.8619 | (81) | | | | | | |
| Solar gains | 84.3900 | 147.6874 | 212.5378 | 280.8863 | 330.6272 | 335.2791 | 320.3139 | 282.1282 | 236.0379 | 166.0478 | 101.7973 | 71.7560 | (83) |
| Total gains | 420.2644 | 481.0218 | 533.5904 | 582.6118 | 612.9102 | 598.7261 | 571.8627 | 539.7363 | 503.8325 | 453.3616 | 411.4043 | 398.0603 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (85) |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 0.9970 | 0.9931 | 0.9822 | 0.9449 | 0.8449 | 0.6632 | 0.4938 | 0.5426 | 0.7955 | 0.9625 | 0.9933 | 0.9977 | (86) |
| tau | 66.9766 | 67.1458 | 67.3124 | 68.1062 | 68.2568 | 68.9668 | 68.9668 | 69.0999 | 68.6916 | 68.2568 | 67.9528 | 67.6379 | (87) |
| alpha | 5.4651 | 5.4764 | 5.4875 | 5.5404 | 5.5505 | 5.5978 | 5.5978 | 5.6067 | 5.5794 | 5.5505 | 5.5302 | 5.5092 | (88) |
| util living area | 19.9635 | 20.1142 | 20.3453 | 20.6355 | 20.8632 | 20.9731 | 20.9956 | 20.9927 | 20.9275 | 20.6338 | 20.2442 | 19.9354 | (89) |
| MIT | 20.0527 | 20.0549 | 20.0570 | 20.0670 | 20.0689 | 20.0776 | 20.0776 | 20.0792 | 20.0742 | 20.0689 | 20.0651 | 20.0611 | (90) |
| util rest of house | 0.9960 | 0.9909 | 0.9762 | 0.9261 | 0.7965 | 0.5799 | 0.3930 | 0.4387 | 0.7212 | 0.9459 | 0.9908 | 0.9970 | (91) |
| MIT 2 | 18.6717 | 18.8925 | 19.2278 | 19.6432 | 19.9372 | 20.0600 | 20.0759 | 20.0762 | 20.0181 | 19.6495 | 19.0904 | 18.6368 | (92) |
| Living area fraction | 19.0155 | 19.2176 | 19.5252 | 19.9073 | 20.1837 | 20.3030 | 20.3207 | 20.3201 | 20.2602 | 19.9115 | 19.3975 | 18.9824 | (93) |
| Temperature adjustment | 19.0155 | 19.2176 | 19.5252 | 19.9073 | 20.1837 | 20.3030 | 20.3207 | 20.3201 | 20.2602 | 19.9115 | 19.3975 | 18.9824 | (94) |
| adjusted MIT | 19.0155 | 19.2176 | 19.5252 | 19.9073 | 20.1837 | 20.3030 | 20.3207 | 20.3201 | 20.2602 | 19.9115 | 19.3975 | 18.9824 | (95) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (94) |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|------|
| Useful gains | 417.9357 | 475.3354 | 518.5331 | 537.3416 | 492.2180 | 359.8716 | 240.1553 | 251.7500 | 371.5808 | 427.2111 | 406.5503 | 396.3824 | (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 | 982.5946 | 953.6213 | 865.3929 | 722.7982 | 555.8543 | 369.8165 | 241.2722 | 253.7156 | 401.0620 | 610.0931 | 809.3436 | 977.4141 | (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | (98) |
| Space heating kWh | 420.1062 | 321.4081 | 258.0637 | 133.5288 | 47.3454 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 136.0643 | 290.0111 | 432.2876 | (99) |
| Space heating per m2 | | | | | | | | | | | | 2038.8152 | (98) |
| | | | | | | | | | | | | 31.6586 | (99) |

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 93.4000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2182.8856 (211) |
| Space heating requirement | 420.1062 | 321.4081 | 258.0637 | 133.5288 | 47.3454 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 136.0643 | 290.0111 | 432.2876 | (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) | 449.7925 | 344.1201 | 276.2994 | 142.9644 | 50.6910 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 145.6791 | 310.5044 | 462.8347 | (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 | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | (64) |
| Efficiency of water heater (217)m | 87.0594 | 86.7566 | 86.1340 | 84.7821 | 82.5838 | 80.3000 | 80.3000 | 80.3000 | 80.3000 | 84.7110 | 86.4364 | 87.1753 | (217) |
| Fuel for water heating, kWh/month | 211.8429 | 185.6960 | 194.6011 | 175.3538 | 174.2926 | 157.8730 | 151.2544 | 168.6132 | 170.4753 | 184.0120 | 192.5083 | 206.5928 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2173.1156 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2182.8856 (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) | | | | | | | | | | | | | 304.5642 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4735.5654 (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 | 2182.8856 | 0.2160 | 471.5033 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 2173.1156 | 0.2160 | 469.3930 | (264) |
| Space and water heating | | | 940.8963 | (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 | (267) |
| Energy for lighting | 304.5642 | 0.5190 | 158.0688 | (268) |
| Total CO2, kg/m2/year | | | 1137.8901 | (272) |
| Emissions per m2 for space and water heating | | | 14.6102 | (272a) |
| Fuel factor (mains gas) | | | 1.0000 | |
| Emissions per m2 for lighting | | | 2.4545 | (272b) |
| Emissions per m2 for pumps and fans | | | 0.6044 | (272c) |
| Target Carbon Dioxide Emission Rate (TER) - (14.6102 * 1.00) 2.4545 0.6044, rounded to 2 d.p. | | | 17.6700 | (273) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.3780 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3213 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4097 | 0.4017 | 0.3936 | 0.3535 | 0.3454 | 0.3053 | 0.3053 | 0.2972 | 0.3213 | 0.3454 | 0.3615 | 0.3776 (22b) |
| Effective ac | 0.5839 | 0.5807 | 0.5775 | 0.5625 | 0.5597 | 0.5466 | 0.5466 | 0.5442 | 0.5516 | 0.5597 | 0.5653 | 0.5713 (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 (Uw = 1.41) | | | 9.8900 | 1.3347 | 13.2004 | | (27) | | | | | |
| Opening Type 7 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm TE Platinum GF | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.2700 | 7.8705 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1100 | 3.5420 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 30.7689 | (33) | | | | | |
| E-WM-20/22 | | | 74.5600 | 0.0000 | 0.0000 | | (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 192.6000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.1597 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 37.9286 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2174 | Feb 30.0488 | Mar 29.8835 | Apr 29.1070 | May 28.9617 | Jun 28.2855 | Jul 28.2855 | Aug 28.1602 | Sep 28.5460 | Oct 28.9617 | Nov 29.2556 | Dec 29.5629 (38) |
| Heat transfer coeff | 68.1460 | 67.9774 | 67.8121 | 67.0356 | 66.8904 | 66.2141 | 66.2141 | 66.0889 | 66.4746 | 66.8904 | 67.1842 | 67.4915 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 67.0349 (39) |
| HLP | Jan 1.0582 | Feb 1.0555 | Mar 1.0530 | Apr 1.0409 | May 1.0387 | Jun 1.0282 | Jul 1.0282 | Aug 1.0262 | Sep 1.0322 | Oct 1.0387 | Nov 1.0432 | Dec 1.0480 (40) |
| HLP (average) | | | | | | | | | | | | 1.0409 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (59) |
| Heat gains from water heating, kWh/month | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | 26.0125 | 28.2478 | 26.0125 | 28.2478 | (65) |

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

| | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | | | |
| (66)m | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) | |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) | |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) | |
| Water heating gains (Table 5) | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) | |
| Total internal gains | 294.8862 | 293.6240 | 283.3753 | 266.6050 | 249.0245 | 232.5753 | 222.2158 | 225.7272 | 234.6368 | 251.5300 | 270.9323 | 286.0147 | (73) | |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------|------------|---------------|---------------|----------|--------------|----------|----------|----------|----------|----------|----------|------|
| [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 | 6.4500 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 81.7381 (77) | | | | | | | |
| Northwest | 3.4400 | 11.2829 | 0.7100 | 0.7000 | 0.7700 | 13.3681 (81) | | | | | | | |
| Solar gains | 95.1062 | 166.4414 | 239.5267 | 316.5544 | 372.6116 | 377.8542 | 360.9887 | 317.9540 | 266.0109 | 187.1332 | 114.7239 | 80.8678 | (83) |
| Total gains | 389.9924 | 460.0654 | 522.9020 | 583.1594 | 621.6362 | 610.4295 | 583.2046 | 543.6813 | 500.6478 | 438.6632 | 385.6562 | 366.8825 | (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | | |
|---|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| tau | 50.5591 | 50.6845 | 50.8081 | 51.3965 | 51.5082 | 52.0342 | 52.0342 | 52.1328 | 51.8303 | 51.5082 | 51.2829 | 51.0494 | |
| alpha | 4.3706 | 4.3790 | 4.3872 | 4.4264 | 4.4339 | 4.4689 | 4.4689 | 4.4755 | 4.4554 | 4.4339 | 4.4189 | 4.4033 | |
| util living area | 0.9939 | 0.9868 | 0.9697 | 0.9217 | 0.8163 | 0.6461 | 0.4881 | 0.5401 | 0.7792 | 0.9479 | 0.9881 | 0.9953 | (86) |
| MIT | 19.6350 | 19.8344 | 20.1328 | 20.5003 | 20.7905 | 20.9462 | 20.9877 | 20.9810 | 20.8746 | 20.4887 | 19.9911 | 19.5986 | (87) |
| Th 2 | 20.0351 | 20.0373 | 20.0394 | 20.0494 | 20.0512 | 20.0599 | 20.0599 | 20.0615 | 20.0566 | 20.0512 | 20.0475 | 20.0435 | (88) |
| util rest of house | 0.9923 | 0.9835 | 0.9617 | 0.9010 | 0.7699 | 0.5676 | 0.3891 | 0.4384 | 0.7103 | 0.9298 | 0.9845 | 0.9941 | (89) |
| MIT 2 | 18.7887 | 18.9880 | 19.2832 | 19.6440 | 19.9050 | 20.0324 | 20.0560 | 20.0549 | 19.9828 | 19.6414 | 19.1528 | 18.7590 | (90) |
| Living area fraction | fLA = Living area / (4) = | | | | | | | | | | | | |
| MIT | 19.0139 | 19.2133 | 19.5093 | 19.8719 | 20.1407 | 20.2756 | 20.3040 | 20.3014 | 20.2201 | 19.8669 | 19.3759 | 18.9824 | (92) |
| Temperature adjustment | 0.0000 | | | | | | | | | | | | |
| adjusted MIT | 19.0139 | 19.2133 | 19.5093 | 19.8719 | 20.1407 | 20.2756 | 20.3040 | 20.3014 | 20.2201 | 19.8669 | 19.3759 | 18.9824 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| | 0.9901 | 0.9798 | 0.9563 | 0.8965 | 0.7747 | 0.5865 | 0.4154 | 0.4652 | 0.7235 | 0.9255 | 0.9812 | 0.9922 | (94) |
| Useful gains | 386.1250 | 450.7726 | 500.0702 | 522.7898 | 481.5769 | 358.0246 | 242.2678 | 252.9459 | 362.1981 | 405.9917 | 378.3986 | 364.0362 | (95) |
| Ext temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | (96) |
| Heat loss rate W | 1002.6963 | 972.9820 | 882.1907 | 735.5091 | 564.6017 | 375.8049 | 245.2548 | 257.8373 | 406.8335 | 619.8676 | 824.7502 | 997.6884 | (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | (97a) |
| Space heating kWh | 458.7291 | 350.9247 | 284.2976 | 153.1578 | 61.7705 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 159.1237 | 321.3732 | 471.4373 | (98) |
| Space heating | | | | | | | | | | | | | |
| Space heating per m2 | (98) / (4) = | | | | | | | | | | | | |
| | 2260.8139 (98) | | | | | | | | | | | | |
| | 35.1058 (99) | | | | | | | | | | | | |

8c. Space cooling requirement

| | | | | | | | | | | | | | |
|---|----------------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------|--------|
| Calculated for June, July and August. See Table 10b | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 622.4126 | 489.9843 | 502.2754 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9004 | 0.9448 | 0.9281 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 560.4406 | 462.9247 | 466.1475 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 792.1417 | 758.7920 | 713.9555 | 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 | 166.8248 | 220.1252 | 184.3692 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |
| Space cooling | | | | | | | | | | | | | |
| | 571.3192 (104) | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------------------------|--------------|
| Cooled fraction | | | | | | | | | | | FC = cooled area / (4) = | 1.0000 (105) |
| Intermittency factor (Table 10b) | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2500 | 0.2500 | 0.2500 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (106) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 41.7062 | 55.0313 | 46.0923 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling | | | | | | | | | | | 142.8298 (107) | |
| Space cooling per m2 | | | | | | | | | | | 2.2179 (108) | |
| Energy for space heating | | | | | | | | | | | 35.1058 (99) | |
| Energy for space cooling | | | | | | | | | | | 2.2179 (108) | |
| Total | | | | | | | | | | | 37.3237 (109) | |
| Dwelling Fabric Energy Efficiency (DFEE) | | | | | | | | | | | 37.3 (109) | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.3775 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3209 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4092 | 0.4011 | 0.3931 | 0.3530 | 0.3450 | 0.3049 | 0.3049 | 0.2968 | 0.3209 | 0.3450 | 0.3610 | 0.3771 (22b) |
| Effective ac | 0.5837 | 0.5805 | 0.5773 | 0.5623 | 0.5595 | 0.5465 | 0.5465 | 0.5441 | 0.5515 | 0.5595 | 0.5652 | 0.5711 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|-------------|-----------------------------|---------------|-------------|-------------|-------------|-------------|------------------|
| TER Opaque door | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 9.8900 | 1.3258 | 13.1117 | | (27) | | | | | |
| 150mm TE Platinum GF | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.1800 | 5.2470 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1300 | 4.1860 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 28.7007 | | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.8662 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 36.5669 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2059 | Feb 30.0377 | Mar 29.8729 | Apr 29.0985 | May 28.9536 | Jun 28.2791 | Jul 28.2791 | Aug 28.1542 | Sep 28.5389 | Oct 28.9536 | Nov 29.2467 | Dec 29.5531 (38) |
| Heat transfer coeff | 66.7729 | 66.6047 | 66.4398 | 65.6654 | 65.5205 | 64.8461 | 64.8461 | 64.7211 | 65.1059 | 65.5205 | 65.8136 | 66.1201 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 65.6647 (39) |
| HLP | Jan 1.0368 | Feb 1.0342 | Mar 1.0317 | Apr 1.0196 | May 1.0174 | Jun 1.0069 | Jul 1.0069 | Aug 1.0050 | Sep 1.0110 | Oct 1.0174 | Nov 1.0220 | Dec 1.0267 (40) |
| HLP (average) | | | | | | | | | | | | 1.0196 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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 (46) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-------------|
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (57) |
| Heat gains from water heating, kWh/month | 0.0000 | 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) |
| | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) |
| Total internal gains | 294.8862 | 293.6240 | 283.3753 | 266.6050 | 249.0245 | 232.5753 | 222.2158 | 225.7272 | 234.6368 | 251.5300 | 270.9323 | 286.0147 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | g | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | | |
|-------------|------------|--------------------------------|------------------------------|----------|------------------------------|----------|------------------------------|--------------|----------|----------|----------|----------|------|
| Southeast | 6.4500 | 36.7938 | 0.6300 | | 0.7000 | | 0.7700 | 72.5281 (77) | | | | | |
| Northwest | 3.4400 | 11.2829 | 0.6300 | | 0.7000 | | 0.7700 | 11.8619 (81) | | | | | |
| Solar gains | 84.3900 | 147.6874 | 212.5378 | 280.8863 | 330.6272 | 335.2791 | 320.3139 | 282.1282 | 236.0379 | 166.0478 | 101.7973 | 71.7560 | (83) |
| Total gains | 379.2762 | 441.3114 | 495.9131 | 547.4913 | 579.6518 | 567.8544 | 542.5298 | 507.8555 | 470.6747 | 417.5778 | 372.7295 | 357.7707 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 66.9766 | 67.1458 | 67.3124 | 68.1062 | 68.2568 | 68.9668 | 68.9668 | 69.0999 | 68.6916 | 68.2568 | 67.9528 | 67.6379 | 21.0000 (85) |
| tau | 5.4651 | 5.4764 | 5.4875 | 5.5404 | 5.5505 | 5.5978 | 5.5978 | 5.6067 | 5.5794 | 5.5505 | 5.5302 | 5.5092 | |
| util living area | 0.9982 | 0.9954 | 0.9871 | 0.9567 | 0.8677 | 0.6919 | 0.5190 | 0.5737 | 0.8276 | 0.9734 | 0.9959 | 0.9987 | (86) |
| MIT | 19.9033 | 20.0569 | 20.2938 | 20.5955 | 20.8410 | 20.9669 | 20.9944 | 20.9905 | 20.9106 | 20.5891 | 20.1883 | 19.8759 | (87) |
| Th 2 | 20.0527 | 20.0549 | 20.0570 | 20.0670 | 20.0689 | 20.0776 | 20.0776 | 20.0792 | 20.0742 | 20.0689 | 20.0651 | 20.0611 | (88) |
| util rest of house | 0.9976 | 0.9939 | 0.9826 | 0.9411 | 0.8229 | 0.6078 | 0.4139 | 0.4653 | 0.7571 | 0.9607 | 0.9942 | 0.9982 | (89) |
| MIT 2 | 19.0499 | 19.2046 | 19.4408 | 19.7413 | 19.9622 | 20.0625 | 20.0761 | 20.0764 | 20.0254 | 19.7413 | 19.3443 | 19.0294 | (90) |
| Living area fraction | 19.2770 | 19.4315 | 19.6678 | 19.9686 | 20.1961 | 20.3032 | 20.3205 | 20.3197 | 20.2610 | 19.9669 | 19.5689 | 19.2547 | (91) |
| MIT | 19.2770 | 19.4315 | 19.6678 | 19.9686 | 20.1961 | 20.3032 | 20.3205 | 20.3197 | 20.2610 | 19.9669 | 19.5689 | 19.2547 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 19.2770 | 19.4315 | 19.6678 | 19.9686 | 20.1961 | 20.3032 | 20.3205 | 20.3197 | 20.2610 | 19.9669 | 19.5689 | 19.2547 | (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|--------------|
| Utilisation | 0.9969 | 0.9926 | 0.9803 | 0.9391 | 0.8297 | 0.6294 | 0.4420 | 0.4944 | 0.7729 | 0.9590 | 0.9930 | 0.9977 | (94) |
| Useful gains | 378.0973 | 438.0362 | 486.1352 | 514.1576 | 480.9292 | 357.4009 | 239.8179 | 251.0701 | 363.7977 | 400.4601 | 370.1266 | 356.9532 | (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 | 1000.0594 | 967.8634 | 874.8692 | 726.8266 | 556.6690 | 369.8292 | 241.2601 | 253.6887 | 401.1193 | 613.7248 | 820.6264 | 995.4167 | (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 | 462.7398 | 356.0439 | 289.2180 | 153.1216 | 56.3504 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 158.6690 | 324.3599 | 475.0168 | (98) |
| Space heating | | | | | | | | | | | | 2275.5191 | (98) |
| Space heating per m2 | | | | | | | | | | | | (98) / (4) = | 35.3342 (99) |

8c. Space cooling requirement

| Calculated for June, July and August. See Table 10b | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|----------|--------------|
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 609.5529 | 479.8608 | 491.8807 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9184 | 0.9612 | 0.9466 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 559.8364 | 461.2237 | 465.6255 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 742.3786 | 711.2500 | 672.0812 | 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 | 131.4303 | 186.0196 | 153.6030 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |
| Space cooling | | | | | | | | | | | | 471.0529 | (104) |
| Cooled fraction | | | | | | | | | | | | | 1.0000 (105) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------|----------------|
| Intermittency factor (Table 10b) | 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 | 32.8576 | 46.5049 | 38.4008 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (107) |
| Space cooling | | | | | | | | | | | | 117.7632 (107) |
| Space cooling per m2 | | | | | | | | | | | | 1.8286 (108) |
| Energy for space heating | | | | | | | | | | | | 35.3342 (99) |
| Energy for space cooling | | | | | | | | | | | | 1.8286 (108) |
| Total | | | | | | | | | | | | 37.1628 (109) |
| Target Fabric Energy Efficiency (TFEE) | | | | | | | | | | | | 42.7 (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

| | | | | | |
|--|---|-----------------------|-------|-----------------------|------------|
| Property Reference | Braondon Mid-Terrace BeamBlock | | | Issued on Date | 15/10/2021 |
| Assessment Reference | 1 | Prop Type Ref | | | |
| Property | Plot 183, Chipping Lane , Longridge , PR3 | | | | |
| SAP Rating | 84 B | DER | 16.75 | TER | 18.12 |
| Environmental | 88 B | % DER<TER | 7.54 | | |
| CO₂ Emissions (t/year) | 0.95 | DFEE | 38.77 | TFEE | 44.98 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.80 | | |
| Assessor Details | Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk | | | Assessor ID | T759-0001 |
| Client | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 64 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) 18.12 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.8 kWh/m²/yrOK

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|----|
| External wall | 0.27 (max. 0.30) | 0.27 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.34 (max. 2.00) | 1.41 (max. 3.30) | OK |

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

OK

Minimum: 88.0%

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines (England)):Not significant OK

Based on:

Overshading:

Average

Windows facing South East: 3.44 m², No overhang

Windows facing North West: 6.45 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | 2.3100 (2b) | 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | 2.5600 (2c) | 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|--------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | 3 * 10 = | 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1913 (8) | | | | | | | |
| Pressure test | | | | Yes | | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.4418 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3755 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4788 | 0.4694 | 0.4600 | 0.4131 | 0.4037 | 0.3568 | 0.3568 | 0.3474 | 0.3755 | 0.4037 | 0.4225 | 0.4413 (22b) |
| Effective ac | 0.6146 | 0.6102 | 0.6058 | 0.5853 | 0.5815 | 0.5636 | 0.5636 | 0.5603 | 0.5705 | 0.5815 | 0.5892 | 0.5974 (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 (Uw = 1.41) | | | 9.8900 | 1.3347 | 13.2004 | | (27) | | | | | |
| Opening Type 7 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm B&B | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.2700 | 7.8705 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1100 | 3.5420 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 30.7689 | (33) | | | | | |
| E-WM-20/22 | | | 74.5600 | 0.0000 | 0.0000 | | (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 192.6000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 6.5489 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 37.3178 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 31.8063 | Feb 31.5759 | Mar 31.3501 | Apr 30.2896 | May 30.0912 | Jun 29.1676 | Jul 29.1676 | Aug 28.9965 | Sep 29.5233 | Oct 30.0912 | Nov 30.4926 | Dec 30.9122 (38) |
| Heat transfer coeff | 69.1240 | 68.8937 | 68.6679 | 67.6074 | 67.4090 | 66.4853 | 66.4853 | 66.3143 | 66.8411 | 67.4090 | 67.8104 | 68.2300 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 67.6065 (39) |
| HLP | Jan 1.0734 | Feb 1.0698 | Mar 1.0663 | Apr 1.0498 | May 1.0467 | Jun 1.0324 | Jul 1.0324 | Aug 1.0297 | Sep 1.0379 | Oct 1.0467 | Nov 1.0530 | Dec 1.0595 (40) |
| HLP (average) | | | | | | | | | | | | 1.0498 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| Assumed occupancy | 2.1029 (42) | | | | | | | | | | | |
|--|--------------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Average daily hot water use (litres/day) | 84.1444 (43) | | | | | | | | | | | |
| Daily hot water use | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Energy conte | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy content (annual) | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (45) |
| Water storage loss: | 20.5893 | 18.0075 | 18.5822 | 16.2004 | 15.5447 | 13.4139 | 12.4299 | 14.2635 | 14.4339 | 16.8213 | 18.3617 | 19.9397 (46) |
| 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) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

| | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|----------|----------|----------|------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) |
| Combi loss | 14.0615 | 12.6823 | 14.0117 | 13.5265 | 13.9533 | 13.4753 | 13.9072 | 13.9371 | 13.5032 | 13.9876 | 13.5748 | 14.0519 | 14.0519 | 14.0519 | (61) |
| Total heat required for water heating calculated for each month | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | 146.9829 | 146.9829 | (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 | 0.0000 | 0.0000 | (63) |
| Output from w/h | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | 146.9829 | 146.9829 | (64) |
| Heat gains from water heating, kWh/month | 49.1550 | 43.0873 | 44.6934 | 39.2925 | 37.9457 | 33.1029 | 31.0298 | 35.1017 | 35.3709 | 40.7840 | 44.0956 | 47.7125 | 47.7125 | 47.7125 | (65) |

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 66.0686 | 64.1180 | 60.0718 | 54.5729 | 51.0022 | 45.9762 | 41.7067 | 47.1797 | 49.1262 | 54.8173 | 61.2438 | 64.1297 | (72) |
| Total internal gains | 324.7503 | 322.7797 | 311.0644 | 292.3021 | 273.4278 | 255.1585 | 243.2544 | 248.7475 | 258.3631 | 277.3175 | 299.0477 | 315.1769 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------------|------------------|---------------|---------------|----------|--------------|----------|----------|----------|----------|----------|----------|------|
| [Jan] | Area | Solar flux | α | FF | Access | Gains | | | | | | | |
| | m ² | Table 6a | Specific data | Specific data | factor | W | | | | | | | |
| | | W/m ² | or Table 6b | or Table 6c | Table 6d | | | | | | | | |
| Southeast | 3.4400 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 43.5936 (77) | | | | | | | |
| Northwest | 6.4500 | 11.2829 | 0.7100 | 0.7000 | 0.7700 | 25.0652 (81) | | | | | | | |
| Solar gains | 68.6589 | 125.2771 | 193.5240 | 276.8528 | 343.9314 | 356.3264 | 337.3434 | 285.0246 | 222.0221 | 144.4205 | 83.7537 | 57.7766 | (83) |
| Total gains | 393.4091 | 448.0568 | 504.5884 | 569.1550 | 617.3592 | 611.4849 | 580.5979 | 533.7720 | 480.3852 | 421.7380 | 382.8013 | 372.9535 | (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nil _m (see Table 9a) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| tau | 49.8437 | 50.0104 | 50.1748 | 50.9619 | 51.1119 | 51.8220 | 51.8220 | 51.9556 | 51.5461 | 51.1119 | 50.8093 | 50.4968 | |
| alpha | 4.3229 | 4.3340 | 4.3450 | 4.3975 | 4.4075 | 4.4548 | 4.4548 | 4.4637 | 4.4364 | 4.4075 | 4.3873 | 4.3665 | |
| util living area | 0.9937 | 0.9882 | 0.9736 | 0.9281 | 0.8213 | 0.6470 | 0.4918 | 0.5503 | 0.7991 | 0.9547 | 0.9885 | 0.9950 | (86) |
| MIT | 19.6162 | 19.7910 | 20.0842 | 20.4719 | 20.7814 | 20.9454 | 20.9872 | 20.9793 | 20.8587 | 20.4558 | 19.9726 | 19.5904 | (87) |
| Th 2 | 20.0227 | 20.0256 | 20.0285 | 20.0420 | 20.0446 | 20.0564 | 20.0564 | 20.0586 | 20.0519 | 20.0446 | 20.0394 | 20.0341 | (88) |
| util rest of house | 0.9921 | 0.9851 | 0.9665 | 0.9086 | 0.7753 | 0.5682 | 0.3919 | 0.4471 | 0.7320 | 0.9384 | 0.9850 | 0.9937 | (89) |
| MIT 2 | 18.1735 | 18.4296 | 18.8550 | 19.4117 | 19.8205 | 20.0154 | 20.0504 | 20.0480 | 19.9283 | 19.4012 | 18.7049 | 18.1438 | (90) |
| Living area fraction | | | | | | | | | | fLA = Living area / (4) = | | 0.2661 | (91) |
| MIT | 18.5574 | 18.7920 | 19.1822 | 19.6939 | 20.0763 | 20.2629 | 20.2997 | 20.2959 | 20.1759 | 19.6818 | 19.0423 | 18.5288 | (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 | |
| adjusted MIT | 18.4074 | 18.6420 | 19.0322 | 19.5439 | 19.9263 | 20.1129 | 20.1497 | 20.1459 | 20.0259 | 19.5318 | 18.8923 | 18.3788 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|-----------|-------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Useful gains | 388.7345 | 438.6611 | 482.8111 | 510.0750 | 474.6652 | 350.5303 | 233.4464 | 243.9673 | 350.6398 | 390.9416 | 374.7707 | 369.3623 | (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 | 975.1635 | 946.7344 | 860.5578 | 719.6060 | 554.5243 | 366.5291 | 236.0046 | 248.4042 | 396.0923 | 602.0867 | 799.6397 | 967.4215 | (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 | 436.3032 | 341.4253 | 281.0436 | 150.8623 | 59.4152 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 157.0919 | 305.9057 | 444.9560 | (98) |
| Space heating | | | | | | | | | | | | 2177.0032 | (98) |
| Space heating per m ² | | | | | | | | | | (98) / (4) = | | 33.8044 | (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 | | | | | | | | | | | | | 2405.5284 (211) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 436.3032 | 341.4253 | 281.0436 | 150.8623 | 59.4152 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 157.0919 | 305.9057 | 444.9560 | (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) | 482.1030 | 377.2655 | 310.5454 | 166.6987 | 65.6521 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 173.5822 | 338.0173 | 491.6641 | (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 | 151.3236 | 132.7326 | 137.8929 | 121.5292 | 117.5844 | 102.9011 | 96.7733 | 109.0271 | 109.7290 | 126.1294 | 135.9864 | 146.9829 | (64) |
| Efficiency of water heater (217)m | 89.6537 | 89.5808 | 89.4211 | 89.0438 | 88.3486 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 89.0464 | 89.4905 | 87.3000 | (216) |
| Fuel for water heating, kWh/month | 168.7867 | 148.1708 | 154.2062 | 136.4825 | 133.0913 | 117.8706 | 110.8514 | 124.8879 | 125.6918 | 141.6445 | 151.9562 | 163.8903 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1677.5302 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2405.5284 (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) | | | | | | | | | | | | | 304.5642 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4462.6228 (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 | 2405.5284 | 0.2160 | 519.5941 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1677.5302 | 0.2160 | 362.3465 (264) |
| Space and water heating | | | 881.9407 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 304.5642 | 0.5190 | 158.0688 (268) |
| Total CO2, kg/year | | | 1078.9345 (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 16.7500 (273) |

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

| | | | |
|---|--|---------|-----|
| DER | | 16.7500 | ZC1 |
| Total Floor Area | | 64.4000 | |
| Assumed number of occupants | | 2.1029 | |
| CO2 emission factor in Table 12 for electricity displaced from grid | | 0.5190 | |
| CO2 emissions from appliances, equation (L14) | | 16.9209 | ZC2 |
| CO2 emissions from cooking, equation (L16) | | 2.6315 | ZC3 |
| Total CO2 emissions | | 36.3024 | ZC4 |
| Residual CO2 emissions offset from biofuel CHP | | 0.0000 | ZC5 |
| Additional allowable electricity generation, kWh/m ² /year | | 0.0000 | ZC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation | | 0.0000 | ZC7 |
| Net CO2 emissions | | 36.3024 | ZC8 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.3775 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3209 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4092 | 0.4011 | 0.3931 | 0.3530 | 0.3450 | 0.3049 | 0.3049 | 0.2968 | 0.3209 | 0.3450 | 0.3610 | 0.3771 (22b) |
| Effective ac | 0.5837 | 0.5805 | 0.5773 | 0.5623 | 0.5595 | 0.5465 | 0.5465 | 0.5441 | 0.5515 | 0.5595 | 0.5652 | 0.5711 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|---------------|-------------|-------------|-------------|-------------|------------------|
| TER Opaque door | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 9.8900 | 1.3258 | 13.1117 | | (27) | | | | | |
| 150mm B&B | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.1800 | 5.2470 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1300 | 4.1860 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 28.7007 | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.8662 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 36.5669 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2059 | Feb 30.0377 | Mar 29.8729 | Apr 29.0985 | May 28.9536 | Jun 28.2791 | Jul 28.2791 | Aug 28.1542 | Sep 28.5389 | Oct 28.9536 | Nov 29.2467 | Dec 29.5531 (38) |
| Heat transfer coeff | 66.7729 | 66.6047 | 66.4398 | 65.6654 | 65.5205 | 64.8461 | 64.8461 | 64.7211 | 65.1059 | 65.5205 | 65.8136 | 66.1201 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 65.6647 (39) |
| HLP | Jan 1.0368 | Feb 1.0342 | Mar 1.0317 | Apr 1.0196 | May 1.0174 | Jun 1.0069 | Jul 1.0069 | Aug 1.0050 | Sep 1.0110 | Oct 1.0174 | Nov 1.0220 | Dec 1.0267 (40) |
| HLP (average) | | | | | | | | | | | | 1.0196 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water storage loss: | 20.5893 | 18.0075 | 18.5822 | 16.2004 | 15.5447 | 13.4139 | 12.4299 | 14.2635 | 14.4339 | 16.8213 | 18.3617 | 19.9397 (46) |
| 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 | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Combi 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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) | |
| Total heat required for water heating calculated for each month | 47.1670 | 41.0533 | 43.7367 | 40.6660 | 40.3063 | 37.3463 | 38.5912 | 40.3063 | 40.6660 | 43.7367 | 43.9856 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | 47.1670 | (61) |
| Solar input | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (62) |
| Output from w/h | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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) |
| Heat gains from water heating, kWh/month | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | 180.0980 | (64) |
| | 57.4314 | 50.1800 | 52.1247 | 46.0774 | 44.5339 | 39.0706 | 37.2008 | 41.6940 | 42.1615 | 48.2213 | 51.6983 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | 55.9913 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (66) |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | 77.1927 | 74.6727 | 70.0600 | 63.9963 | 59.8574 | 54.2648 | 50.0010 | 56.0404 | 58.5577 | 64.8136 | 71.8031 | 75.2571 | (72) |
| Total internal gains | 335.8744 | 333.3344 | 321.0526 | 301.7256 | 282.2830 | 263.4470 | 251.5488 | 257.6081 | 267.7946 | 287.3138 | 309.6070 | 326.3043 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 5a W/m2 | Specific data or Table 5b | g Specific data or Table 5c | FF | Access factor Table 5d | Gains W | (77) | | | | | |
|-------------|----------|--------------------------|---------------------------|-----------------------------|----------|------------------------|----------|----------|----------|----------|----------|----------|------|
| Southeast | 3.4400 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 38.6817 | (77) | | | | | | |
| Northwest | 6.4500 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 22.2410 | (81) | | | | | | |
| Solar gains | 60.9227 | 111.1614 | 171.7185 | 245.6581 | 305.1786 | 316.1769 | 299.3329 | 252.9091 | 197.0055 | 128.1478 | 74.3166 | 51.2666 | (83) |
| Total gains | 396.7971 | 444.4957 | 492.7711 | 547.3837 | 587.4616 | 579.6240 | 550.8817 | 510.5172 | 464.8001 | 415.4616 | 383.9236 | 377.5709 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (85) |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 0.9977 | 0.9953 | 0.9875 | 0.9567 | 0.8624 | 0.6808 | 0.5116 | 0.5710 | 0.8332 | 0.9739 | 0.9952 | 0.9983 | (86) |
| tau | 66.9766 | 67.1458 | 67.3124 | 68.1062 | 68.2568 | 68.9668 | 68.9668 | 69.0999 | 68.6916 | 68.2568 | 67.9528 | 67.6379 | (87) |
| alpha | 5.4651 | 5.4764 | 5.4875 | 5.5404 | 5.5505 | 5.5978 | 5.5978 | 5.6067 | 5.5794 | 5.5505 | 5.5302 | 5.5092 | (88) |
| util living area | 0.9977 | 0.9953 | 0.9875 | 0.9567 | 0.8624 | 0.6808 | 0.5116 | 0.5710 | 0.8332 | 0.9739 | 0.9952 | 0.9983 | (86) |
| MIT | 19.9291 | 20.0616 | 20.2894 | 20.5954 | 20.8465 | 20.9694 | 20.9948 | 20.9907 | 20.9073 | 20.5864 | 20.2046 | 19.9052 | (87) |
| Th 2 | 20.0527 | 20.0549 | 20.0570 | 20.0670 | 20.0689 | 20.0776 | 20.0776 | 20.0792 | 20.0742 | 20.0689 | 20.0651 | 20.0611 | (88) |
| util rest of house | 0.9970 | 0.9937 | 0.9831 | 0.9411 | 0.8167 | 0.5969 | 0.4077 | 0.4629 | 0.7636 | 0.9615 | 0.9933 | 0.9977 | (89) |
| MIT 2 | 18.6215 | 18.8162 | 19.1483 | 19.5898 | 19.9188 | 20.0573 | 20.0756 | 20.0753 | 19.9996 | 19.5853 | 19.0330 | 18.5927 | (90) |
| Living area fraction | 18.9695 | 19.1477 | 19.4520 | 19.8574 | 20.1657 | 20.3001 | 20.3202 | 20.3189 | 20.2412 | 19.8517 | 19.3448 | 18.9420 | (92) |
| Temperature adjustment | 18.9695 | 19.1477 | 19.4520 | 19.8574 | 20.1657 | 20.3001 | 20.3202 | 20.3189 | 20.2412 | 19.8517 | 19.3448 | 18.9420 | (92) |
| adjusted MIT | 18.9695 | 19.1477 | 19.4520 | 19.8574 | 20.1657 | 20.3001 | 20.3202 | 20.3189 | 20.2412 | 19.8517 | 19.3448 | 18.9420 | (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (94) |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------|
| Useful gains | 0.9957 | 0.9916 | 0.9794 | 0.9369 | 0.8220 | 0.6181 | 0.4355 | 0.4918 | 0.7777 | 0.9578 | 0.9913 | 0.9967 | (94) |
| Ext temp. | 395.1007 | 410.7560 | 482.6171 | 512.8168 | 482.8878 | 358.2500 | 239.9031 | 251.0845 | 361.4532 | 397.9287 | 380.5676 | 376.3237 | (95) |
| Heat loss rate W | 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) |
| Month fracti | 979.5266 | 948.9619 | 860.5293 | 719.5231 | 554.6768 | 369.6272 | 241.2419 | 253.6368 | 399.8285 | 606.1790 | 805.8767 | 974.7442 | (97) |
| Space heating kWh | 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 per m2 | 434.8129 | 341.5144 | 281.1667 | 148.8286 | 53.4111 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 154.9382 | 306.2226 | 445.2248 | (98) |
| | | | | | | | | | | | | 2166.1192 | (98) |
| | | | | | | | | | | | | 33.6354 | (99) |

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 93.4000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 2319.1854 (211) |
| Space heating requirement | 434.8129 | 341.5144 | 281.1667 | 148.8286 | 53.4111 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 154.9382 | 306.2226 | 445.2248 | (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) | 465.5384 | 365.6471 | 301.0350 | 159.3453 | 57.1853 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 165.8867 | 327.8615 | 476.6861 | (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 | 184.4291 | 161.1036 | 167.6178 | 148.6686 | 143.9374 | 126.7720 | 121.4573 | 135.3964 | 136.8917 | 155.8785 | 166.3972 | 180.0980 | (64) |
| Efficiency of water heater (217)m | 87.1358 | 86.8967 | 86.3438 | 85.0539 | 82.8038 | 80.3000 | 80.3000 | 80.3000 | 80.3000 | 85.0360 | 86.5665 | 87.2397 | (217) |
| Fuel for water heating, kWh/month | 211.6570 | 185.3966 | 194.1284 | 174.7933 | 173.8295 | 157.8730 | 151.2544 | 168.6132 | 170.4753 | 183.3088 | 192.2188 | 206.4404 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2169.9887 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2319.1854 (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) | | | | | | | | | | | | | 304.5642 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4068.7384 (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 | 2319.1854 | 0.2160 | 500.9441 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 2169.9887 | 0.2160 | 468.7176 | (264) |
| Space and water heating | | | 969.6616 | (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 | (267) |
| Energy for lighting | 304.5642 | 0.5190 | 158.0688 | (268) |
| Total CO2, kg/m2/year | | | 1166.6554 | (272) |
| Emissions per m2 for space and water heating | | | 15.0569 | (272a) |
| Fuel factor (mains gas) | | | 1.0000 | |
| Emissions per m2 for lighting | | | 2.4545 | (272b) |
| Emissions per m2 for pumps and fans | | | 0.6044 | (272c) |
| Target Carbon Dioxide Emission Rate (TER) - (15.0569 * 1.00) 2.4545 0.6044, rounded to 2 d.p. | | | 18.1200 | (273) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.3780 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3213 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4097 | 0.4017 | 0.3936 | 0.3535 | 0.3454 | 0.3053 | 0.3053 | 0.2972 | 0.3213 | 0.3454 | 0.3615 | 0.3776 (22b) |
| Effective ac | 0.5839 | 0.5807 | 0.5775 | 0.5625 | 0.5597 | 0.5466 | 0.5466 | 0.5442 | 0.5516 | 0.5597 | 0.5653 | 0.5713 (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 (Uw = 1.41) | | | 9.8900 | 1.3347 | 13.2004 | | (27) | | | | | |
| Opening Type 7 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm B&B | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.2700 | 7.8705 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1100 | 3.5420 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 30.7689 | (33) | | | | | |
| E-WM-20/22 | | | 74.5600 | 0.0000 | 0.0000 | | (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 192.6000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 6.5489 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 37.3178 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2174 | Feb 30.0488 | Mar 29.8835 | Apr 29.1070 | May 28.9617 | Jun 28.2855 | Jul 28.2855 | Aug 28.1602 | Sep 28.5460 | Oct 28.9617 | Nov 29.2556 | Dec 29.5629 (38) |
| Heat transfer coeff | 67.5352 | 67.3666 | 67.2012 | 66.4248 | 66.2795 | 65.6033 | 65.6033 | 65.4780 | 65.8637 | 66.2795 | 66.5734 | 66.8806 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 66.4241 (39) |
| HLP | Jan 1.0487 | Feb 1.0461 | Mar 1.0435 | Apr 1.0314 | May 1.0292 | Jun 1.0187 | Jul 1.0187 | Aug 1.0167 | Sep 1.0227 | Oct 1.0292 | Nov 1.0337 | Dec 1.0385 (40) |
| HLP (average) | | | | | | | | | | | | 1.0314 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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 | 0.0000 | (59) |
| Heat gains from water heating, kWh/month | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | 28.2478 | (65) |

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

| | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) | |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) | |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) | |
| Water heating gains (Table 5) | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) | |
| Total internal gains | 294.8862 | 293.6240 | 283.3753 | 266.6050 | 249.0245 | 232.5753 | 222.2158 | 225.7272 | 234.6368 | 251.5300 | 270.9323 | 286.0147 | (73) | |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|------------|--------------------------------|------------------------------|-----------------------------------|----------|------------------------------|------------|----------|----------|----------|----------|----------|------|
| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | g Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | | | |
| Southeast | 3.4400 | 36.7938 | 0.7100 | 0.7000 | 0.7700 | 43.5936 | (77) | | | | | | |
| Northwest | 6.4500 | 11.2829 | 0.7100 | 0.7000 | 0.7700 | 25.0652 | (81) | | | | | | |
| Solar gains | 68.6589 | 125.2771 | 193.5240 | 276.8528 | 343.9314 | 356.3264 | 337.3434 | 285.0246 | 222.0221 | 144.4205 | 83.7537 | 57.7766 | (83) |
| Total gains | 363.5451 | 418.9011 | 476.8993 | 543.4578 | 592.9559 | 588.9017 | 559.5592 | 510.7518 | 456.6590 | 395.9505 | 354.6859 | 343.7913 | (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | | | |
|---|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | | 21.0000 | (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| tau | 51.0164 | 51.1441 | 51.2699 | 51.8692 | 51.9829 | 52.5187 | 52.5187 | 52.6192 | 52.3110 | 51.9829 | 51.7534 | 51.5156 | | |
| alpha | 4.4011 | 4.4096 | 4.4180 | 4.4579 | 4.4655 | 4.5012 | 4.5012 | 4.5079 | 4.4874 | 4.4655 | 4.4502 | 4.4344 | | |
| util living area | 0.9953 | 0.9907 | 0.9778 | 0.9358 | 0.8325 | 0.6601 | 0.5028 | 0.5660 | 0.8158 | 0.9624 | 0.9913 | 0.9964 | (86) | |
| MIT | 19.6037 | 19.7787 | 20.0727 | 20.4599 | 20.7752 | 20.9429 | 20.9866 | 20.9778 | 20.8498 | 20.4356 | 19.9506 | 19.5730 | (87) | |
| Th 2 | 20.0430 | 20.0451 | 20.0472 | 20.0572 | 20.0591 | 20.0678 | 20.0678 | 20.0694 | 20.0644 | 20.0591 | 20.0553 | 20.0514 | (88) | |
| util rest of house | 0.9941 | 0.9883 | 0.9718 | 0.9180 | 0.7883 | 0.5818 | 0.4023 | 0.4620 | 0.7514 | 0.9485 | 0.9886 | 0.9954 | (89) | |
| MIT 2 | 18.7637 | 18.9393 | 19.2316 | 19.6140 | 19.9005 | 20.0382 | 20.0634 | 20.0615 | 19.9733 | 19.5988 | 19.1192 | 18.7397 | (90) | |
| Living area fraction | fLA = Living area / (4) = | | | | | | | | | | | | | |
| MIT | 18.9873 | 19.1627 | 19.4554 | 19.8391 | 20.1333 | 20.2790 | 20.3091 | 20.3054 | 20.2066 | 19.8215 | 19.3404 | 18.9614 | (92) | |
| Temperature adjustment | 0.0000 | | | | | | | | | | | | | |
| adjusted MIT | 18.9873 | 19.1627 | 19.4554 | 19.8391 | 20.1333 | 20.2790 | 20.3091 | 20.3054 | 20.2066 | 19.8215 | 19.3404 | 18.9614 | (93) | |

8. Space heating requirement

| | | | | | | | | | | | | | | |
|----------------------|--------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| Useful gains | 0.9923 | 0.9853 | 0.9671 | 0.9132 | 0.7921 | 0.6005 | 0.4290 | 0.4894 | 0.7624 | 0.9441 | 0.9859 | 0.9939 | (94) | |
| 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 | 991.9095 | 960.8305 | 870.6223 | 726.6275 | 558.9543 | 372.5611 | 243.3323 | 255.7153 | 402.2026 | 611.1982 | 814.8872 | 987.2549 | (97) | |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | (97a) | |
| Space heating kWh | 169.5795 | 368.3056 | 301.6105 | 165.8648 | 66.4103 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 176.6083 | 331.9429 | 180.2923 | (98) | |
| Space heating | 2366.6141 | | | | | | | | | | | | (98) | |
| Space heating per m2 | (98) / (4) = | | | | | | | | | | | | 36.7487 | (99) |

8c. Space cooling requirement

| | | | | | | | | | | | | | |
|---|----------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------|--------|
| Calculated for June, July and August. See Table 10b | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 616.6707 | 485.4641 | 497.6330 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8949 | 0.9406 | 0.9184 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 551.8818 | 456.6103 | 457.0424 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 766.9793 | 731.1546 | 675.4665 | 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 | 154.8702 | 204.2610 | 162.5076 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |
| Space cooling | 521.6387 | | | | | | | | | | | | (104) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------------------------|--------------|
| Cooled fraction | | | | | | | | | | | | FC = cooled area / (4) = | 1.0000 (105) |
| Intermittency factor (Table 10b) | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2500 | 0.2500 | 0.2500 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (106) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 38.7175 | 51.0652 | 40.6269 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (107) |
| Space cooling | | | | | | | | | | | | 130.4097 | (107) |
| Space cooling per m2 | | | | | | | | | | | | 2.0250 | (108) |
| Energy for space heating | | | | | | | | | | | | 36.7487 | (99) |
| Energy for space cooling | | | | | | | | | | | | 2.0250 | (108) |
| Total | | | | | | | | | | | | 38.7737 | (109) |
| Dwelling Fabric Energy Efficiency (DFEE) | | | | | | | | | | | | 38.8 | (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 32.2000 (1b) | x 2.3100 (2b) | = 74.3820 (1b) - (3b) |
| First floor | 32.2000 (1c) | x 2.5600 (2c) | = 82.4320 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 64.4000 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 156.8140 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 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) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 20.0000 / (5) = 0.1275 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.3775 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.3209 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | | | | | | | | | | | | |
| Effective ac | 0.4092 | 0.4011 | 0.3931 | 0.3530 | 0.3450 | 0.3049 | 0.3049 | 0.2968 | 0.3209 | 0.3450 | 0.3610 | 0.3771 (22b) |
| | 0.5837 | 0.5805 | 0.5773 | 0.5623 | 0.5595 | 0.5465 | 0.5465 | 0.5441 | 0.5515 | 0.5595 | 0.5652 | 0.5711 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|------------------------------|-----------------------------|---------------|-------------|-------------|-------------|-------------|------------------|
| TER Opaque door | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 9.8900 | 1.3258 | 13.1117 | | (27) | | | | | |
| 150mm B&B | | | 32.2000 | 0.1300 | 4.1860 | | (28a) | | | | | |
| 50mm Alreflex Plat | 41.0100 | 11.8600 | 29.1500 | 0.1800 | 5.2470 | | (29a) | | | | | |
| 400mm mineral | 32.2000 | | 32.2000 | 0.1300 | 4.1860 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 105.4100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 28.7007 | | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 7.8662 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 36.5669 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 30.2059 | Feb 30.0377 | Mar 29.8729 | Apr 29.0985 | May 28.9536 | Jun 28.2791 | Jul 28.2791 | Aug 28.1542 | Sep 28.5389 | Oct 28.9536 | Nov 29.2467 | Dec 29.5531 (38) |
| Heat transfer coeff | 66.7729 | 66.6047 | 66.4398 | 65.6654 | 65.5205 | 64.8461 | 64.8461 | 64.7211 | 65.1059 | 65.5205 | 65.8136 | 66.1201 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 65.6647 (39) |
| HLP | Jan 1.0368 | Feb 1.0342 | Mar 1.0317 | Apr 1.0196 | May 1.0174 | Jun 1.0069 | Jul 1.0069 | Aug 1.0050 | Sep 1.0110 | Oct 1.0174 | Nov 1.0220 | Dec 1.0267 (40) |
| HLP (average) | | | | | | | | | | | | 1.0196 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.1029 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 84.1444 (43) |
| Daily hot water use | 92.5589 | 89.1931 | 85.8273 | 82.4615 | 79.0958 | 75.7300 | 75.7300 | 79.0958 | 82.4615 | 85.8273 | 89.1931 | 92.5589 (44) |
| Energy conte | 137.2621 | 120.0503 | 123.8812 | 108.0026 | 103.6311 | 89.4257 | 82.8661 | 95.0901 | 96.2257 | 112.1418 | 122.4116 | 132.9310 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1323.9193 (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 (46) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|------|
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) |
| Heat gains from water heating, kWh/month | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 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) |
| | 29.1682 | 25.5107 | 26.3248 | 22.9506 | 22.0216 | 19.0030 | 17.6090 | 20.2066 | 20.4480 | 23.8301 | 26.0125 | 28.2478 | (65) | | | | | | |

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

| | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| (66)m | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | 105.1461 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| | 17.2457 | 15.3175 | 12.4570 | 9.4308 | 7.0496 | 5.9516 | 6.4309 | 8.3591 | 11.2196 | 14.2458 | 16.6270 | 17.7250 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| | 183.8921 | 185.8004 | 180.9917 | 170.7546 | 157.8322 | 145.6868 | 137.5730 | 135.6648 | 140.4735 | 150.7106 | 163.6330 | 175.7783 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | 33.5146 | (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) | | | | | | | | | | | | | |
| | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | -84.1169 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| | 39.2046 | 37.9623 | 35.3827 | 31.8758 | 29.5989 | 26.3930 | 23.6681 | 27.1595 | 28.4000 | 32.0298 | 36.1284 | 37.9675 | (72) |
| Total internal gains | | | | | | | | | | | | | |
| | 294.8862 | 293.6240 | 283.3753 | 266.6050 | 249.0245 | 232.5753 | 222.2158 | 225.7272 | 234.6368 | 251.5300 | 270.9323 | 286.0147 | (73) |

6. Solar gains

| | | | | | | | | | | | | | |
|-------------|----------|------------|---------------|---------------|----------|--------------|----------|----------|----------|----------|----------|----------|------|
| [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 | 3.4400 | 36.7938 | 0.6300 | 0.7000 | 0.7700 | 38.6817 (77) | | | | | | | |
| Northwest | 6.4500 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 22.2410 (81) | | | | | | | |
| Solar gains | 60.9227 | 111.1614 | 171.7185 | 245.6581 | 305.1786 | 316.1769 | 299.3329 | 252.9091 | 197.0055 | 128.1478 | 74.3166 | 51.2666 | (83) |
| Total gains | 355.8089 | 404.7854 | 455.0938 | 512.2631 | 554.2031 | 548.7522 | 521.5487 | 478.6363 | 431.6424 | 379.6777 | 345.2489 | 337.2813 | (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Thl (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 | 66.9766 | 67.1458 | 67.3124 | 68.1062 | 68.2568 | 68.9668 | 68.9668 | 69.0999 | 68.6916 | 68.2568 | 67.9528 | 67.6379 | (86) |
| alpha | 5.4651 | 5.4764 | 5.4875 | 5.5404 | 5.5505 | 5.5978 | 5.5978 | 5.6067 | 5.5794 | 5.5505 | 5.5302 | 5.5092 | |
| util living area | | | | | | | | | | | | | |
| | 0.9987 | 0.9970 | 0.9913 | 0.9669 | 0.8845 | 0.7104 | 0.5384 | 0.6049 | 0.8644 | 0.9824 | 0.9972 | 0.9990 | (86) |
| MIT | | | | | | | | | | | | | |
| | 19.8687 | 20.0037 | 20.2365 | 20.5530 | 20.8219 | 20.9623 | 20.9933 | 20.9877 | 20.8861 | 20.5391 | 20.1481 | 19.8455 | (87) |
| Th 2 | | | | | | | | | | | | | |
| | 20.0527 | 20.0549 | 20.0570 | 20.0670 | 20.0689 | 20.0776 | 20.0776 | 20.0792 | 20.0742 | 20.0689 | 20.0651 | 20.0611 | (88) |
| util rest of house | | | | | | | | | | | | | |
| | 0.9982 | 0.9960 | 0.9882 | 0.9543 | 0.8428 | 0.6261 | 0.4301 | 0.4925 | 0.8006 | 0.9735 | 0.9960 | 0.9987 | (89) |
| MIT 2 | | | | | | | | | | | | | |
| | 19.0154 | 19.1518 | 19.3848 | 19.7019 | 19.9474 | 20.0601 | 20.0758 | 20.0756 | 20.0093 | 19.6941 | 19.3045 | 18.9991 | (90) |
| Living area fraction | | | | | | | | | | | | | |
| | 19.2425 | 19.3785 | 19.6115 | 19.9284 | 20.1802 | 20.3003 | 20.3200 | 20.3183 | 20.2427 | 19.9190 | 19.5290 | 19.2244 | (91) |
| Temperature adjustment | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (92) |
| adjusted MIT | | | | | | | | | | | | | |
| | 19.2425 | 19.3785 | 19.6115 | 19.9284 | 20.1802 | 20.3003 | 20.3200 | 20.3183 | 20.2427 | 19.9190 | 19.5290 | 19.2244 | (93) |

8. Space heating requirement

| | | | | | | | | | | | | | |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|----------|-------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| | 0.9977 | 0.9950 | 0.9863 | 0.9520 | 0.8484 | 0.6476 | 0.4592 | 0.5227 | 0.8139 | 0.9717 | 0.9951 | 0.9983 | (94) |
| Useful gains | 354.9906 | 402.7540 | 448.8382 | 487.6919 | 470.1986 | 355.3754 | 239.4847 | 250.1606 | 351.2976 | 368.9218 | 343.5512 | 336.7009 | (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 | | | | | | | | | | | | | |
| | 997.7532 | 964.3372 | 871.1257 | 724.1843 | 555.6258 | 369.6392 | 241.2263 | 253.5989 | 399.9237 | 610.5847 | 817.9967 | 993.4130 | (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 | | | | | | | | | | | | | |
| | 478.2154 | 377.3839 | 314.1819 | 170.2745 | 63.5578 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 179.7972 | 341.6008 | 488.5937 | (98) |
| Space heating per m2 | | | | | | | | | | | | | |
| | | | | | | | | | | (98) / (4) = | | 37.4783 | (99) |

8c. Space cooling requirement

| | | | | | | | | | | | | | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|----------|--------|
| Calculated for June, July and August. See Table 10b | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 609.5529 | 479.8608 | 491.8807 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.9094 | 0.9553 | 0.9351 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 554.3498 | 458.4086 | 459.9334 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 720.0514 | 686.7267 | 637.9290 | 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 | 119.3051 | 169.8687 | 132.4287 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |
| Space cooling | | | | | | | | | | | | | |
| | | | | | | | | | | | | 421.6025 | (104) |
| Cooled fraction | | | | | | | | | | | | | |
| | | | | | | | | | | | | 1.0000 | (105) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|---------|---------|---------|--------|--------|--------|----------|-------|
| Intermittency factor (Table 10b) | 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 | 29.8263 | 42.4672 | 33.1072 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (107) |
| Space cooling | | | | | | | | | | | 105.4006 | (107) |
| Space cooling per m2 | | | | | | | | | | | 1.6367 | (108) |
| Energy for space heating | | | | | | | | | | | 37.4783 | (99) |
| Energy for space cooling | | | | | | | | | | | 1.6367 | (108) |
| Total | | | | | | | | | | | 39.1150 | (109) |
| Target Fabric Energy Efficiency (TFEE) | | | | | | | | | | | 45.0 | (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

| | | | | | |
|--|---|-----------------------|-----------------------|--------------------|-----------|
| Property Reference | Denby Detached | | Issued on Date | 15/10/2021 | |
| Assessment Reference | 1 | Prop Type Ref | | | |
| Property | Plot 031, Chipping Lane , Longridge , PR3 | | | | |
| SAP Rating | 82 B | DER | 19.88 | TER | 20.48 |
| Environmental | 84 B | % DER<TER | 2.93 | | |
| CO₂ Emissions (t/year) | 1.47 | DFEE | 56.45 | TFEE | 62.40 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 9.54 | | |
| Assessor Details | Mr. William Vincent, William Vincent, Tel: 01582544250, William.Vincent@ee-ltd.co.uk | | | Assessor ID | T759-0001 |
| Client | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 80 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) 20.48 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.88 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 56.4 kWh/m²/yrOK

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|----|
| External wall | 0.27 (max. 0.30) | 0.28 (max. 0.70) | OK |
| Floor | 0.17 (max. 0.25) | 0.20 (max. 0.70) | OK |
| Roof | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.36 (max. 2.00) | 1.41 (max. 3.30) | OK |

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage: No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines (England)):Not significant OK

Based on:

Overshading: Average
Windows facing North: 5.42 m², No overhang
Windows facing East: 0.66 m², No overhang
Windows facing South: 8.43 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|---------------------------------|--------------------------|
| Ground floor | 35.2600 (1b) | x 2.3100 (2b) | = 81.4506 (1b) - (3b) |
| First floor | 44.8200 (1c) | x 2.5600 (2c) | = 114.7392 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 80.0800 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 196.1898 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | + | 0 | = | 0 * 20 = 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | | 4 * 10 = 40.0000 (7a) | | | | | | | |
| Number of passive vents | | | | | 0 * 10 = 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | | 0 * 40 = 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 40.0000 / (5) = 0.2039 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.4544 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | | (21) = (18) x (20) = 0.3862 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4924 | 0.4828 | 0.4731 | 0.4248 | 0.4152 | 0.3669 | 0.3669 | 0.3573 | 0.3862 | 0.4152 | 0.4345 | 0.4538 (22b) |
| Effective ac | 0.6212 | 0.6165 | 0.6119 | 0.5902 | 0.5862 | 0.5673 | 0.5673 | 0.5638 | 0.5746 | 0.5862 | 0.5944 | 0.6030 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|---------------|-------------|-------------|-------------|-------------|------------------|
| Opening Type 1 (Uw = 1.41) | | | 14.5100 | 1.3347 | 19.3668 | | (27) | | | | | |
| Opening Type 5 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm TE Platinum GF | | | 35.2600 | 0.1600 | 5.6416 | | (28a) | | | | | |
| Over Garage | | | 9.5700 | 0.2000 | 1.9140 | | (28b) | | | | | |
| BDW Std 50mm AP | 118.0500 | 16.4800 | 101.5700 | 0.2700 | 27.4239 | | (29a) | | | | | |
| Cavity to garage | 2.5400 | | 2.5400 | 0.2300 | 0.5842 | | (29a) | | | | | |
| Solid Wall to Garage | 14.3700 | | 14.3700 | 0.2800 | 4.0236 | | (29a) | | | | | |
| 400mm MW | 44.8200 | | 44.8200 | 0.1100 | 4.9302 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 224.6100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 65.8543 | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 147.0100 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 10.8345 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 76.6888 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 40.2212 | Feb 39.9164 | Mar 39.6176 | Apr 38.2142 | May 37.9517 | Jun 36.7294 | Jul 36.7294 | Aug 36.5030 | Sep 37.2002 | Oct 37.9517 | Nov 38.4828 | Dec 39.0382 (38) |
| Heat transfer coeff | 116.9100 | 116.6052 | 116.3064 | 114.9031 | 114.6405 | 113.4182 | 113.4182 | 113.1918 | 113.8890 | 114.6405 | 115.1717 | 115.7270 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 114.9018 (39) |
| HLP | Jan 1.4599 | Feb 1.4561 | Mar 1.4524 | Apr 1.4349 | May 1.4316 | Jun 1.4163 | Jul 1.4163 | Aug 1.4135 | Sep 1.4222 | Oct 1.4316 | Nov 1.4382 | Dec 1.4451 (40) |
| HLP (average) | | | | | | | | | | | | 1.4348 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.4644 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.6094 (43) |
| Daily hot water use | 107.3704 | 103.4660 | 99.5616 | 95.6572 | 91.7529 | 87.8485 | 87.8485 | 91.7529 | 95.6572 | 99.5616 | 103.4660 | 107.3704 (44) |
| Energy conte | 159.2272 | 139.2611 | 143.7050 | 125.2855 | 120.2144 | 103.7359 | 96.1265 | 110.3066 | 111.6240 | 130.0870 | 142.0002 | 154.2030 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1535.7764 (45) |
| Distribution loss (46)m = 0.15 x (45)m | 23.8841 | 20.8892 | 21.5557 | 18.7928 | 18.0322 | 15.5604 | 14.4190 | 16.5460 | 16.7436 | 19.5131 | 21.3000 | 23.1305 (46) |
| Water storage loss: | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 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 | 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 | 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 | 14.1387 | 12.7595 | 14.0999 | 13.6004 | 14.0213 | 13.5315 | 13.9592 | 13.9995 | 13.5691 | 14.0674 | 13.6536 | 14.1266 | | | | | | | | | | | | | (61) |
| Total heat required for water heating calculated for each month | 173.3659 | 152.0206 | 157.8049 | 138.8859 | 134.2357 | 117.2674 | 110.0858 | 124.3061 | 125.1931 | 144.1544 | 155.6538 | 168.3297 | | | | | | | | | | | | | (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 | 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) |
| Output from w/h | 173.3659 | 152.0206 | 157.8049 | 138.8859 | 134.2357 | 117.2674 | 110.0858 | 124.3061 | 125.1931 | 144.1544 | 155.6538 | 168.3297 | | | | | | | | | | | | | (64) |
| Heat gains from water heating, kWh/month | 56.4777 | 49.4942 | 51.3069 | 45.0575 | 43.4766 | 37.8751 | 35.4519 | 40.1768 | 40.5073 | 46.7708 | 50.6285 | 54.8042 | | | | | | | | | | | | | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 19.9754 | 17.7420 | 14.4287 | 10.9235 | 8.1654 | 6.8936 | 7.4488 | 9.6822 | 12.9954 | 16.5007 | 19.2587 | 20.5306 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 219.6077 | 221.8865 | 216.1439 | 203.9186 | 188.4863 | 173.9821 | 164.2925 | 162.0136 | 167.7562 | 179.9815 | 195.4138 | 209.9180 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | (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) | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | (71) |
| Water heating gains (Table 5) | 75.9109 | 73.6521 | 68.9609 | 62.5799 | 58.4363 | 52.6043 | 47.6504 | 54.0011 | 56.2601 | 62.8640 | 70.3173 | 73.6615 | (72) |
| Total internal gains | 378.4596 | 376.2462 | 362.4992 | 340.3876 | 318.0537 | 296.4456 | 282.3573 | 288.6626 | 299.9774 | 322.3119 | 347.9555 | 367.0757 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | | | |
|-------------|----------|--------------------------|---------------------------|---------------------------|----------|------------------------|---------------|----------|----------|----------|----------|----------|------|
| North | 5.4200 | 10.6334 | 0.7100 | | 0.7000 | 0.7700 | 19.8500 (74) | | | | | | |
| East | 0.6600 | 19.6403 | 0.7100 | | 0.7000 | 0.7700 | 4.4646 (76) | | | | | | |
| South | 8.4300 | 46.7521 | 0.7100 | | 0.7000 | 0.7700 | 135.7432 (78) | | | | | | |
| Solar gains | 160.0578 | 268.9804 | 362.0294 | 444.5781 | 498.7091 | 496.6024 | 478.0672 | 436.6783 | 390.0514 | 295.3039 | 190.9563 | 137.5140 | (83) |
| Total gains | 538.5174 | 645.2266 | 724.5286 | 784.9657 | 816.7627 | 793.0481 | 760.4245 | 725.3409 | 690.0288 | 617.6157 | 538.9118 | 504.5897 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | | 21.0000 (85) |
| tau | 27.9716 | 28.0447 | 28.1167 | 28.4601 | 28.5253 | 28.8327 | 28.8327 | 28.8904 | 28.7135 | 28.5253 | 28.3938 | 28.2575 | |
| alpha | 2.8648 | 2.8696 | 2.8744 | 2.8973 | 2.9017 | 2.9222 | 2.9222 | 2.9260 | 2.9142 | 2.9017 | 2.8929 | 2.8838 | |
| util living area | 0.9818 | 0.9689 | 0.9477 | 0.9069 | 0.8330 | 0.7112 | 0.5748 | 0.6124 | 0.7907 | 0.9226 | 0.9711 | 0.9848 | (86) |
| MIT | 18.7152 | 18.9885 | 19.3925 | 19.9043 | 20.3764 | 20.7374 | 20.8994 | 20.8758 | 20.6108 | 19.9939 | 19.2613 | 18.6687 | (87) |
| Th 2 | 19.7177 | 19.7206 | 19.7234 | 19.7367 | 19.7392 | 19.7509 | 19.7509 | 19.7530 | 19.7464 | 19.7392 | 19.7342 | 19.7289 | (88) |
| util rest of house | 0.9778 | 0.9621 | 0.9357 | 0.8836 | 0.7867 | 0.6229 | 0.4410 | 0.4826 | 0.7177 | 0.8985 | 0.9637 | 0.9814 | (89) |
| MIT 2 | 16.7186 | 17.1152 | 17.6982 | 18.4322 | 19.0787 | 19.5366 | 19.6986 | 19.6828 | 19.3956 | 18.5727 | 17.5227 | 16.6574 | (90) |
| Living area fraction | | | | | | | | | FLA = Living area / (4) = | | | 0.4037 | (91) |
| MIT | 17.5247 | 17.8715 | 18.3822 | 19.0265 | 19.6026 | 20.0214 | 20.1934 | 20.1644 | 19.8862 | 19.1465 | 18.2246 | 17.4694 | (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 | |
| adjusted MIT | 17.3747 | 17.7215 | 18.2322 | 18.8765 | 19.4526 | 19.8714 | 20.0334 | 20.0144 | 19.7362 | 18.9965 | 18.0746 | 17.3194 | (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-------|
| Useful gains | 520.6374 | 611.0073 | 664.2628 | 677.8869 | 632.3560 | 501.6498 | 360.4321 | 371.7912 | 494.7683 | 543.4040 | 511.6747 | 490.3371 | (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 | 1528.5603 | 1495.0503 | 1364.5308 | 1146.3311 | 888.7630 | 597.8685 | 389.4106 | 409.1251 | 641.9058 | 962.5753 | 1263.9635 | 1518.2739 | (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 | 749.8466 | 594.0769 | 520.9994 | 337.2798 | 190.7668 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 311.8634 | 541.6479 | 764.7850 | (98) |
| Space heating | | | | | | | | | | | | 4011.3138 | (98) |
| Space heating per m2 | | | | | | | | | | | | 50.0913 | (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| 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 | | | | | | | | | | | | | 4432.3909 (211) |
| Space heating requirement | 749.8946 | 594.0769 | 520.9994 | 337.2798 | 190.7668 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 311.8634 | 541.6479 | 764.7850 | (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) | 828.6128 | 656.4386 | 575.6899 | 372.6849 | 210.7920 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 344.6005 | 598.5060 | 845.0662 | (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 | 173.3659 | 152.0206 | 157.8049 | 138.8859 | 134.2357 | 117.2674 | 110.0858 | 124.3061 | 125.1931 | 144.1544 | 155.6538 | 168.3297 | (64) |
| Efficiency of water heater (217)m | 89.8814 | 89.8291 | 89.7353 | 89.5427 | 89.1503 | 87.3000 | 87.3000 | 87.3000 | 87.3000 | 89.4634 | 89.7655 | 89.9055 | (216) |
| Fuel for water heating, kWh/month | 192.8830 | 169.2331 | 175.8560 | 155.1059 | 150.5723 | 134.3269 | 126.1005 | 142.3896 | 143.4056 | 161.1324 | 173.4004 | 187.2295 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 1911.6353 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 4432.3909 (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) | | | | | | | | | | | | | 352.7716 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 6771.7978 (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 | 4432.3909 | 0.2160 | 957.3964 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1911.6353 | 0.2160 | 412.9132 (264) |
| Space and water heating | | | 1370.3097 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 352.7716 | 0.5190 | 183.0884 (268) |
| Total CO2, kg/year | | | 1592.3231 (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 19.8800 (273) |

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

| | | | |
|---|--|-----|-------------|
| DER | | | 19.8800 ZC1 |
| Total Floor Area | | TFA | 80.0800 |
| Assumed number of occupants | | N | 2.4644 |
| CO2 emission factor in Table 12 for electricity displaced from grid | | EF | 0.5190 |
| CO2 emissions from appliances, equation (L14) | | | 16.2506 ZC2 |
| CO2 emissions from cooking, equation (L16) | | | 2.2246 ZC3 |
| Total CO2 emissions | | | 38.3552 ZC4 |
| Residual CO2 emissions offset from biofuel CHP | | | 0.0000 ZC5 |
| Additional allowable electricity generation, kWh/m ² /year | | | 0.0000 ZC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation | | | 0.0000 ZC7 |
| Net CO2 emissions | | | 38.3552 ZC8 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|-------------------|--|
| Ground floor | 35.2600 (1b) | x 2.3100 (2b) | = 81.4506 (1b) - (3b) |
| First floor | 44.8200 (1c) | x 2.5600 (2c) | = 114.7392 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 80.0800 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 196.1898 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour | | | | | | | |
|---|--------------|-------------------|-----------------------------|-----------------|-------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | 3 * 10 = | 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1529 (8) | | | | | | | |
| Pressure test | | | | Yes | | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.4029 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.3425 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4367 | 0.4281 | 0.4195 | 0.3767 | 0.3682 | 0.3254 | 0.3254 | 0.3168 | 0.3425 | 0.3682 | 0.3853 | 0.4024 (22b) |
| Effective ac | 0.5953 | 0.5916 | 0.5880 | 0.5710 | 0.5678 | 0.5529 | 0.5529 | 0.5502 | 0.5586 | 0.5678 | 0.5742 | 0.5810 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|----------------------------|-------------|-------------|-------------|-------------|------------------|
| TER Opaque door | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 14.5100 | 1.3258 | 19.2367 | | (27) | | | | | |
| 150mm TE Platinum GF | | | 35.2600 | 0.1300 | 4.5838 | | (28a) | | | | | |
| Over Garage | | | 9.5700 | 0.1300 | 1.2441 | | (28b) | | | | | |
| BDW Std 50mm AP | 118.0500 | 16.4800 | 101.5700 | 0.1800 | 18.2826 | | (29a) | | | | | |
| Cavity to garage | 2.5400 | | 2.5400 | 0.1800 | 0.4572 | | (29a) | | | | | |
| Solid Wall to Garage | 14.3700 | | 14.3700 | 0.1800 | 2.5866 | | (29a) | | | | | |
| 400mm MW | 44.8200 | | 44.8200 | 0.1300 | 5.8266 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 224.6100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | | 54.1876 (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 250.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 15.0165 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 69.2042 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 38.5435 | Feb 38.3039 | Mar 38.0689 | Apr 36.9655 | May 36.7590 | Jun 35.7980 | Jul 35.7980 | Aug 35.6200 | Sep 36.1681 | Oct 36.7590 | Nov 37.1767 | Dec 37.6133 (38) |
| Heat transfer coeff | 107.7477 | 107.5080 | 107.2731 | 106.1697 | 105.9632 | 105.0021 | 105.0021 | 104.8242 | 105.3723 | 105.9632 | 106.3809 | 106.8175 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 106.1687 (39) |
| HLP | Jan 1.3455 | Feb 1.3425 | Mar 1.3396 | Apr 1.3258 | May 1.3232 | Jun 1.3112 | Jul 1.3112 | Aug 1.3090 | Sep 1.3158 | Oct 1.3232 | Nov 1.3284 | Dec 1.3339 (40) |
| HLP (average) | | | | | | | | | | | | 1.3258 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|---------|---------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.4644 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 92.7290 (43) |
| Daily hot water use | 102.0019 | 98.2927 | 94.5835 | 90.8744 | 87.1652 | 83.4561 | 83.4561 | 87.1652 | 90.8744 | 94.5835 | 98.2927 | 102.0019 (44) |
| Energy conte | 151.2658 | 132.2980 | 136.5197 | 119.0212 | 114.2037 | 98.5491 | 91.3202 | 104.7913 | 106.0428 | 123.5827 | 134.9002 | 146.4929 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1458.9876 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| Water storage loss: | 22.6899 | 19.8447 | 20.4780 | 17.8532 | 17.1306 | 14.7824 | 13.6980 | 15.7187 | 15.9064 | 18.5374 | 20.2350 | 21.9739 (46) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------|------|
| 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 | 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 | 0.0000 | (57) |
| Combi loss | 50.9589 | 45.2416 | 48.1987 | 44.8148 | 44.4184 | 41.1564 | 42.5283 | 44.4184 | 44.8148 | 48.1987 | 48.4731 | 50.9589 | (61) | |
| Total heat required for water heating calculated for each month | 202.2247 | 177.5396 | 184.7185 | 163.8360 | 158.6221 | 139.7055 | 133.8485 | 149.2097 | 150.8576 | 171.7814 | 183.3733 | 197.4518 | (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) | |
| Output from w/h | 202.2247 | 177.5396 | 184.7185 | 163.8360 | 158.6221 | 139.7055 | 133.8485 | 149.2097 | 150.8576 | 171.7814 | 183.3733 | 197.4518 | (64) | |
| Heat gains from water heating, kWh/month | 63.0356 | 55.2995 | 57.4425 | 50.7782 | 49.0773 | 43.0567 | 40.9960 | 45.9477 | 46.4629 | 53.1409 | 56.9726 | 61.4486 | (65) | |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 19.9754 | 17.7420 | 14.4287 | 10.9235 | 8.1654 | 6.8936 | 7.4488 | 9.6822 | 12.9954 | 16.5007 | 19.2587 | 20.5306 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 219.6077 | 221.8865 | 216.1439 | 203.9186 | 188.4863 | 173.9821 | 164.2925 | 162.0136 | 167.7562 | 179.9815 | 195.4138 | 209.9180 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | (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) | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | (71) |
| Water heating gains (Table 5) | 84.7253 | 82.2909 | 77.2077 | 70.5253 | 65.9642 | 59.8009 | 55.1022 | 61.7577 | 64.5318 | 71.4260 | 79.1286 | 82.5922 | (72) |
| Total internal gains | 387.2740 | 384.8850 | 370.7459 | 348.3330 | 325.5815 | 303.6423 | 289.8091 | 296.4192 | 308.2492 | 330.8739 | 356.7668 | 376.0064 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | | | |
|-------------|----------|--------------------------|---------------------------|---------------------------|----------|------------------------|----------|----------|----------|----------|----------|----------|------|
| North | 5.4200 | 10.6334 | 0.6300 | 0.7000 | 0.7700 | 17.6134 | (74) | | | | | | |
| East | 0.6600 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 3.9615 | (76) | | | | | | |
| South | 8.4300 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 120.4482 | (78) | | | | | | |
| Solar gains | 142.0231 | 238.6727 | 321.2373 | 394.4848 | 442.5165 | 440.6472 | 424.2005 | 387.4751 | 346.1020 | 262.0302 | 169.4401 | 122.0195 | (83) |
| Total gains | 529.2971 | 623.5578 | 691.9833 | 742.8178 | 768.0980 | 744.2896 | 714.0096 | 683.8943 | 654.3511 | 592.9041 | 526.2069 | 498.0259 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 51.6123 | 51.7274 | 51.8407 | 52.3795 | 52.4815 | 52.9619 | 52.9619 | 53.0518 | 52.7758 | 52.4815 | 52.2755 | 52.0618 | (85) |
| tau | 4.4408 | 4.4485 | 4.4560 | 4.4920 | 4.4988 | 4.5308 | 4.5308 | 4.5368 | 4.5184 | 4.4988 | 4.4850 | 4.4708 | (86) |
| alpha | 0.9969 | 0.9932 | 0.9848 | 0.9621 | 0.9036 | 0.7750 | 0.6121 | 0.6553 | 0.8591 | 0.9706 | 0.9937 | 0.9977 | (86) |
| util living area | 19.5598 | 19.7405 | 20.0092 | 20.3523 | 20.6687 | 20.8916 | 20.9716 | 20.9612 | 20.8123 | 20.4014 | 19.9144 | 19.5274 | (87) |
| MIT | 19.8054 | 19.8077 | 19.8100 | 19.8207 | 19.8227 | 19.8321 | 19.8321 | 19.8338 | 19.8284 | 19.8227 | 19.8186 | 19.8144 | (88) |
| util rest of house | 0.9958 | 0.9908 | 0.9792 | 0.9468 | 0.8614 | 0.6781 | 0.4666 | 0.5124 | 0.7843 | 0.9556 | 0.9911 | 0.9968 | (89) |
| MIT 2 | 17.9086 | 18.1732 | 18.5643 | 19.0614 | 19.4912 | 19.7575 | 19.8217 | 19.8179 | 19.6777 | 19.1389 | 18.4353 | 17.8674 | (90) |
| Living area fraction | 18.5752 | 18.8060 | 19.1476 | 19.5826 | 19.9666 | 20.2153 | 20.2859 | 20.2794 | 20.1357 | 19.6486 | 19.0324 | 18.5376 | (92) |
| Temperature adjustment | 18.5752 | 18.8060 | 19.1476 | 19.5826 | 19.9666 | 20.2153 | 20.2859 | 20.2794 | 20.1357 | 19.6486 | 19.0324 | 18.5376 | (93) |
| adjusted MIT | FLA = Living area / (4) = 0.4037 (91) | | | | | | | | | | | | |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-------|
| Useful gains | 526.2461 | 616.0622 | 674.6666 | 700.3657 | 666.3107 | 530.7454 | 375.5877 | 390.1399 | 528.0293 | 564.8784 | 520.2242 | 495.8066 | (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 | 1538.1238 | 1495.0055 | 1356.7510 | 1134.1645 | 875.9569 | 589.6234 | 387.0294 | 406.6600 | 635.9990 | 958.8146 | 1269.3835 | 1531.5064 | (97) |
| Month fract1 | 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 | 752.8370 | 590.6500 | 507.4708 | 312.3352 | 155.9768 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 293.0886 | 539.3947 | 770.5607 | (98) |
| Space heating per m2 | (98) / (4) = 48.9799 | | | | | | | | | | | (99) | |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 93.4000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | | | | | | | | | | | | | 4199.4794 (211) |
| Space heating requirement | 752.8370 | 590.6500 | 507.4708 | 312.3352 | 155.9768 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 293.0886 | 539.3947 | 770.5607 | (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) | 806.0353 | 632.3875 | 543.3307 | 334.4059 | 166.9987 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 313.7994 | 577.5104 | 825.0114 | (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 | 202.2247 | 177.5396 | 184.7185 | 163.8360 | 158.6221 | 139.7055 | 133.8485 | 149.2097 | 150.8576 | 171.7814 | 183.3733 | 197.4518 | (64) |
| Efficiency of water heater (217)m | 88.0549 | 87.8464 | 87.4642 | 86.6501 | 85.0089 | 80.3000 | 80.3000 | 80.3000 | 80.3000 | 86.3850 | 87.6044 | 88.1387 | (217) |
| Fuel for water heating, kWh/month | 229.6575 | 202.1024 | 211.1931 | 189.0777 | 186.5947 | 173.9795 | 166.6856 | 185.8154 | 187.8675 | 198.8557 | 209.3196 | 224.0238 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2365.1725 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 4199.4794 (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) | | | | | | | | | | | | | 352.7716 (232) |
| Total delivered energy for all uses | | | | | | | | | | | | | 6992.4234 (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 | 4199.4794 | 0.2160 | 907.0876 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 2365.1725 | 0.2160 | 510.8773 (264) |
| Space and water heating | | | 1417.9648 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 352.7716 | 0.5190 | 183.0884 (268) |
| Total CO2, kg/m2/year | | | 1639.9782 (272) |
| Emissions per m2 for space and water heating | | | 17.7069 (272a) |
| Fuel factor (mains gas) | | | 1.0000 |
| Emissions per m2 for lighting | | | 2.2863 (272b) |
| Emissions per m2 for pumps and fans | | | 0.4861 (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (17.7069 * 1.00) + 2.2863 + 0.4861, rounded to 2 d.p. | | | 20.4800 (273) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 | 35.2600 (1b) | x 2.3100 (2b) | = 81.4506 (1b) - (3b) |
| First floor | 44.8200 (1c) | x 2.5600 (2c) | = 114.7392 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 80.0800 | | (4) |
| Dwelling volume | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 196.1898 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|------------|-----------------------------|----------------------------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | + | 0 | = | 0 * 40 = 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | + | 0 | = | 0 * 20 = 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | | 3 * 10 = 30.0000 (7a) | | | | | | | |
| Number of passive vents | | | | | 0 * 10 = 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | | 0 * 40 = 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | | 30.0000 / (5) = 0.1529 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0100 | | | | | | | |
| Infiltration rate | | | | | 0.4034 (18) | | | | | | | |
| Number of sides sheltered | | | | | 2 (19) | | | | | | | |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | | | (21) = (18) x (20) = 0.3429 (21) | | | | | | | |
| Wind speed | Jan 5.1000 | Feb 5.0000 | Mar 4.9000 | Apr 4.4000 | May 4.3000 | Jun 3.8000 | Jul 3.8000 | Aug 3.7000 | Sep 4.0000 | Oct 4.3000 | Nov 4.5000 | Dec 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 | 0.4372 | 0.4286 | 0.4201 | 0.3772 | 0.3686 | 0.3258 | 0.3258 | 0.3172 | 0.3429 | 0.3686 | 0.3858 | 0.4029 (22b) |
| Effective ac | 0.5956 | 0.5919 | 0.5882 | 0.5711 | 0.5679 | 0.5531 | 0.5531 | 0.5503 | 0.5588 | 0.5679 | 0.5744 | 0.5812 (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 (Uw = 1.41) | | | 14.5100 | 1.3347 | 19.3668 | | (27) | | | | | |
| Opening Type 5 | | | 1.9700 | 1.0000 | 1.9700 | | (26) | | | | | |
| 150mm TE Platinum GF | | | 35.2600 | 0.1600 | 5.6416 | | (28a) | | | | | |
| Over Garage | | | 9.5700 | 0.2000 | 1.9140 | | (28b) | | | | | |
| BDW Std 50mm AP | 118.0500 | 16.4800 | 101.5700 | 0.2700 | 27.4239 | | (29a) | | | | | |
| Cavity to garage | 2.5400 | | 2.5400 | 0.2300 | 0.5842 | | (29a) | | | | | |
| Solid Wall to Garage | 14.3700 | | 14.3700 | 0.2800 | 4.0236 | | (29a) | | | | | |
| 400mm MW | 44.8200 | | 44.8200 | 0.1100 | 4.9302 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 224.6100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 65.8543 | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 147.0100 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 10.8345 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 76.6888 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 38.5589 | Feb 38.3186 | Mar 38.0831 | Apr 36.9769 | May 36.7699 | Jun 35.8065 | Jul 35.8065 | Aug 35.6280 | Sep 36.1776 | Oct 36.7699 | Nov 37.1886 | Dec 37.6263 (38) |
| Heat transfer coeff | 115.2477 | 115.0074 | 114.7719 | 113.6657 | 113.4587 | 112.4953 | 112.4953 | 112.3169 | 112.8664 | 113.4587 | 113.8774 | 114.3151 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 113.6647 (39) |
| HLP | Jan 1.4392 | Feb 1.4362 | Mar 1.4332 | Apr 1.4194 | May 1.4168 | Jun 1.4048 | Jul 1.4048 | Aug 1.4026 | Sep 1.4094 | Oct 1.4168 | Nov 1.4220 | Dec 1.4275 (40) |
| HLP (average) | | | | | | | | | | | | 1.4191 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.4644 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.6094 (43) |
| Daily hot water use | 107.3704 | 103.4660 | 99.5616 | 95.6572 | 91.7529 | 87.8485 | 87.8485 | 91.7529 | 95.6572 | 99.5616 | 103.4660 | 107.3704 (44) |
| Energy conte | 159.2272 | 139.2611 | 143.7050 | 125.2855 | 120.2144 | 103.7359 | 96.1265 | 110.3066 | 111.6240 | 130.0870 | 142.0002 | 154.2030 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1535.7764 (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: | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 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 | 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 | 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 | 0.0000 | (59) |
| Heat gains from water heating, kWh/month | 33.8358 | 29.5930 | 30.5373 | 26.6232 | 25.5456 | 22.0439 | 20.4269 | 23.4402 | 23.7201 | 27.6435 | 30.1750 | 32.7681 | 32.7681 | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (66)m | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | 123.2189 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 19.9754 | 17.7420 | 14.4287 | 10.9235 | 8.1654 | 6.8936 | 7.4488 | 9.6822 | 12.9954 | 16.5007 | 19.2587 | 20.5306 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 219.6077 | 221.8865 | 216.1439 | 203.9186 | 188.4863 | 173.9821 | 164.2925 | 162.0136 | 167.7562 | 179.9815 | 195.4138 | 209.9180 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | 35.3219 | (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) | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | -98.5751 | (71) |
| Water heating gains (Table 5) | 45.4782 | 44.0372 | 41.0448 | 36.9766 | 34.3354 | 30.6165 | 27.4555 | 31.5056 | 32.9446 | 37.1552 | 41.9098 | 44.0432 | (72) |
| Total internal gains | 345.0269 | 343.6313 | 331.5831 | 311.7843 | 290.9528 | 271.4579 | 259.1624 | 263.1671 | 273.6619 | 293.6031 | 316.5480 | 334.4574 | (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | g Specific data or Table 6b | FF Specific data or Table 6c | Access factor Table 6d | Gains W |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|
| North | 5.4200 | 10.6334 | 0.7100 | 0.7000 | 0.7700 | 19.8500 (74) |
| East | 0.6600 | 19.6403 | 0.7100 | 0.7000 | 0.7700 | 4.4646 (76) |
| South | 8.4300 | 46.7521 | 0.7100 | 0.7000 | 0.7700 | 135.7432 (78) |

| | | | | | | | | | | | | | |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Solar gains | 160.0578 | 268.9804 | 362.0294 | 444.5781 | 498.7091 | 496.6024 | 478.0672 | 436.6783 | 390.0514 | 295.3039 | 190.9563 | 137.5140 | (83) |
| Total gains | 505.0847 | 612.6117 | 693.6124 | 756.3624 | 789.6619 | 768.0603 | 737.2296 | 699.8454 | 663.7133 | 588.9070 | 507.5043 | 471.9714 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|------|
| Utilisation factor for gains for living area, nil/m (see Table 9a) | 28.3750 | 28.4343 | 28.4927 | 28.7699 | 28.8224 | 29.0693 | 29.0693 | 29.1154 | 28.9737 | 28.8224 | 28.7165 | 28.6065 | (85) |
| tau | 2.8917 | 2.8956 | 2.8995 | 2.9180 | 2.9215 | 2.9380 | 2.9380 | 2.9410 | 2.9316 | 2.9215 | 2.9144 | 2.9071 | |
| util living area | 0.9845 | 0.9724 | 0.9523 | 0.9130 | 0.8411 | 0.7215 | 0.5850 | 0.6248 | 0.8018 | 0.9296 | 0.9750 | 0.9872 | (86) |
| MIT | 18.6974 | 18.9725 | 19.3785 | 19.8898 | 20.3658 | 20.7301 | 20.8963 | 20.8707 | 20.5992 | 19.9739 | 19.2372 | 18.6467 | (87) |
| Th 2 | 19.7334 | 19.7357 | 19.7380 | 19.7485 | 19.7505 | 19.7597 | 19.7597 | 19.7614 | 19.7561 | 19.7505 | 19.7465 | 19.7423 | (88) |
| util rest of house | 0.9811 | 0.9664 | 0.9413 | 0.8911 | 0.7964 | 0.6344 | 0.4511 | 0.4951 | 0.7310 | 0.9074 | 0.9685 | 0.9843 | (89) |
| MIT 2 | 17.6635 | 17.9369 | 18.3381 | 18.8420 | 19.2890 | 19.6080 | 19.7224 | 19.7108 | 19.5071 | 18.9331 | 18.2096 | 17.6194 | (90) |
| Living area fraction | | | | | | | | | | fLA = Living area / (4) = | | 0.4037 | (91) |
| MIT | 18.0809 | 18.3550 | 18.7582 | 19.2651 | 19.7237 | 20.0610 | 20.1963 | 20.1791 | 19.9480 | 19.3533 | 18.6244 | 18.0341 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 18.0809 | 18.3550 | 18.7582 | 19.2651 | 19.7237 | 20.0610 | 20.1963 | 20.1791 | 19.9480 | 19.3533 | 18.6244 | 18.0341 | (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|--------------|-----------|-------|
| Utilisation | 0.9749 | 0.9576 | 0.9304 | 0.8808 | 0.7953 | 0.6579 | 0.5019 | 0.5428 | 0.7436 | 0.8985 | 0.9606 | 0.9789 | (94) |
| Useful gains | 492.3948 | 586.6134 | 645.3056 | 666.1743 | 628.0366 | 505.2809 | 370.0040 | 379.8656 | 493.5227 | 529.1369 | 487.4952 | 462.0353 | (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 | 1588.2163 | 1547.4263 | 1406.8919 | 1178.1517 | 910.3572 | 614.3410 | 404.5721 | 424.4578 | 660.0428 | 993.1395 | 1312.3733 | 1581.4494 | (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 | 815.2912 | 645.6663 | 566.6202 | 368.6237 | 210.0465 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 345.2179 | 593.9122 | 832.8441 | (98) |
| Space heating | | | | | | | | | | | | 4378.2222 | (98) |
| Space heating per m2 | | | | | | | | | | | (98) / (4) = | 54.6731 | (99) |

9. Space cooling requirement

| Calculated for June, July and August. See Table 10b | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|--------|--------|--------|--------|---------|-----------|----------|----------|---------|---------|--------|--------|--------|
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1057.4556 | 832.4651 | 853.6082 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.7208 | 0.7936 | 0.7694 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 762.1960 | 660.6449 | 656.7677 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 989.5079 | 951.6081 | 909.4639 | 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) |