



|                 |         |        |        |         |                 |
|-----------------|---------|--------|--------|---------|-----------------|
| Party Wall      | 51.0400 | 0.0000 | 0.0000 | 45.0000 | 2296.8000 (32)  |
| PC              | 47.9700 |        |        | 30.0000 | 1439.1000 (32b) |
| Internal Wall 1 | 91.4800 |        |        | 75.0000 | 6861.0000 (32c) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18504.8700 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.5972 (35)

|                                                            |                   |                     |                       |                   |  |
|------------------------------------------------------------|-------------------|---------------------|-----------------------|-------------------|--|
| List of Thermal Bridges                                    |                   |                     |                       |                   |  |
| K1 Element                                                 |                   |                     |                       |                   |  |
| E2 Other lintels (including other steel lintels)           | Length<br>35.0000 | Psi-value<br>0.5000 |                       | Total<br>17.5000  |  |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |                   |                     |                       | 17.5000 (36)      |  |
| Point Thermal bridges                                      |                   |                     |                       | (36a) =<br>0.0000 |  |
| Total fabric heat loss                                     |                   |                     | (33) + (36) + (36a) = | 62.7580 (37)      |  |

|                                            |               |               |               |               |               |               |               |               |               |               |               |                    |
|--------------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------------|
| Monthly Energy Calculation Summary         |               |               |               |               |               |               |               |               |               |               |               |                    |
| Average monthly (38)m = 0.33 x (25)m x (5) |               |               |               |               |               |               |               |               |               |               |               |                    |
| (38)m                                      | 56.6828       | 55.5714       | 54.4600       | 48.9273       | 47.8628       | 42.9071       | 42.9071       | 41.9894       | 44.8160       | 47.8628       | 50.0164       | 52.2371 (38)       |
| Heat transfer coeff                        | 119.4409      | 118.3294      | 117.2180      | 111.6854      | 110.6208      | 105.6652      | 105.6652      | 104.7475      | 107.5740      | 110.6208      | 112.7744      | 114.9951 (39)      |
| Average = Sum(39)m / 12 =                  |               |               |               |               |               |               |               |               |               |               |               | 111.6114           |
| HLP                                        | Jan<br>2.0693 | Feb<br>2.0501 | Mar<br>2.0308 | Apr<br>1.9350 | May<br>1.9165 | Jun<br>1.8307 | Jul<br>1.8307 | Aug<br>1.8148 | Sep<br>1.8637 | Oct<br>1.9165 | Nov<br>1.9538 | Dec<br>1.9923 (40) |
| HLP (average)                              |               |               |               |               |               |               |               |               |               |               |               | 1.9337             |
| Days in mont                               | 31            | 28            | 31            | 30            | 31            | 30            | 31            | 31            | 30            | 31            | 30            | 31                 |

4. Water heating energy requirements (kWh/year)

|                                                                                |                 |                 |                 |                 |                 |                |                |                |                 |                 |                 |                      |
|--------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|----------------------|
| Assumed occupancy                                                              |                 |                 |                 |                 |                 |                |                |                |                 |                 |                 | 1.9165 (42)          |
| Hot water usage for mixer showers                                              | 56.3528         | 55.5059         | 54.2719         | 51.9107         | 50.1683         | 48.2251        | 47.1206        | 48.3453        | 49.6878         | 51.7742         | 54.1861         | 56.1369 (42a)        |
| Hot water usage for baths                                                      | 24.3568         | 23.9950         | 23.4857         | 22.5464         | 21.8431         | 21.0633        | 20.6421        | 21.1479        | 21.6987         | 22.5331         | 23.4917         | 24.2744 (42b)        |
| Hot water usage for other uses                                                 | 34.2568         | 33.0111         | 31.7654         | 30.5197         | 29.2740         | 28.0283        | 28.0283        | 29.2740        | 30.5197         | 31.7654         | 33.0111         | 34.2568 (42c)        |
| Average daily hot water use (litres/day)                                       |                 |                 |                 |                 |                 |                |                |                |                 |                 |                 | 105.6805 (43)        |
| Daily hot water use                                                            | Jan<br>114.9664 | Feb<br>112.5121 | Mar<br>109.5229 | Apr<br>104.9768 | May<br>101.2854 | Jun<br>97.3167 | Jul<br>95.7909 | Aug<br>98.7672 | Sep<br>101.9062 | Oct<br>106.0727 | Nov<br>110.6888 | Dec<br>114.6681 (44) |
| Energy content (annual)                                                        | 182.0786        | 160.2157        | 168.3326        | 143.7080        | 136.3496        | 119.6622       | 115.8508       | 122.2944       | 125.6605        | 143.9396        | 157.6965        | 179.5426 (45)        |
| Distribution loss (46)m = 0.15 x (45)m                                         | 27.3118         | 24.0324         | 25.2499         | 21.5562         | 20.4524         | 17.9493        | 17.3776        | 18.3442        | 18.8491         | 21.5909         | 23.6545         | 26.9314 (46)         |
| Water storage loss:                                                            |                 |                 |                 |                 |                 |                |                |                |                 |                 |                 |                      |
| Total storage loss                                                             | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000         | 0.0000         | 0.0000         | 0.0000          | 0.0000          | 0.0000          | 0.0000 (56)          |
| If cylinder contains dedicated solar storage                                   |                 |                 |                 |                 |                 |                |                |                |                 |                 |                 |                      |
| 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 (57)          |
| Combi loss                                                                     | 50.9589         | 46.0274         | 50.9589         | 49.3151         | 50.9589         | 49.3151        | 50.9589        | 50.9589        | 49.3151         | 50.9589         | 49.3151         | 50.9589 (61)         |
| Total heat required for water heating calculated for each month                | 233.0375        | 206.2431        | 219.2915        | 193.0231        | 187.3085        | 168.9772       | 166.8097       | 173.2533       | 174.9755        | 194.8985        | 207.0116        | 230.5015 (62)        |
| WWHRS                                                                          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000         | 0.0000         | 0.0000         | 0.0000          | 0.0000          | 0.0000          | 0.0000 (63a)         |
| PV diverter                                                                    | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000         | 0.0000         | 0.0000         | 0.0000          | 0.0000          | 0.0000          | 0.0000 (63b)         |
| 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 (63c)         |
| FGHRS                                                                          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000         | 0.0000         | 0.0000         | 0.0000          | 0.0000          | 0.0000          | 0.0000 (63d)         |
| Output from w/h                                                                | 233.0375        | 206.2431        | 219.2915        | 193.0231        | 187.3085        | 168.9772       | 166.8097       | 173.2533       | 174.9755        | 194.8985        | 207.0116        | 230.5015 (64)        |
| 12Total per year (kWh/year)                                                    |                 |                 |                 |                 |                 |                |                |                |                 |                 |                 | 2355.3312 (64)       |
| Electric shower(s)                                                             | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000         | 0.0000         | 0.0000         | 0.0000          | 0.0000          | 0.0000          | 0.0000 (64a)         |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |                 |                 |                 |                 |                 |                |                |                |                 |                 |                 | 0.0000 (64a)         |
| Heat gains from water heating, kWh/month                                       | 73.2809         | 64.7786         | 68.7103         | 60.1117         | 58.0760         | 52.1164        | 51.2601        | 53.4026        | 54.1109         | 60.5997         | 64.7629         | 72.4376 (65)         |

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

|                                                                                     |                |                |                |                |                |                |                |                |                |                |                |                     |
|-------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| Metabolic gains (Table 5), Watts                                                    |                |                |                |                |                |                |                |                |                |                |                |                     |
| (66)m                                                                               | Jan<br>95.8246 | Feb<br>95.8246 | Mar<br>95.8246 | Apr<br>95.8246 | May<br>95.8246 | Jun<br>95.8246 | Jul<br>95.8246 | Aug<br>95.8246 | Sep<br>95.8246 | Oct<br>95.8246 | Nov<br>95.8246 | Dec<br>95.8246 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 84.3142        | 93.3479        | 84.3142        | 87.1247        | 84.3142        | 87.1247        | 84.3142        | 84.3142        | 87.1247        | 84.3142        | 87.1247        | 84.3142 (67)        |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 167.1623       | 168.8970       | 164.5258       | 155.2200       | 143.4732       | 132.4328       | 125.0572       | 123.3225       | 127.6937       | 136.9995       | 148.7463       | 159.7867 (68)       |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825        | 32.5825 (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)                                 | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597       | -76.6597 (71)       |
| Water heating gains (Table 5)                                                       | 98.4958        | 96.3967        | 92.3526        | 83.4885        | 78.0591        | 72.3839        | 68.8980        | 71.7777        | 75.1540        | 81.4512        | 89.9484        | 97.3624 (72)        |
| Total internal gains                                                                | 404.7197       | 413.3889       | 395.9399       | 380.5805       | 360.5938       | 343.6888       | 330.0168       | 331.1618       | 341.7198       | 357.5122       | 380.5668       | 396.2107 (73)       |

[illegible]

|                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|--------|
| (221)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    | (221)  |
| Pumps and Fa                                                                                         | 58.2630 | 52.6247 | 58.2630 | 56.3836 | 58.2630 | 56.3836 | 58.2630 | 56.3836 | 58.2630 | 56.3836 | 58.2630 | 58.2630   | (231)  |
| Lighting                                                                                             | 21.0445 | 16.8827 | 15.2010 | 11.1369 | 8.6025  | 7.0283  | 7.8474  | 10.2004 | 13.2493 | 17.3838 | 19.6350 | 21.6294   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (233a)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    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (234a)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    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235a)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    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235c)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    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (233b)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    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (234b)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    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235b)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    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |           |        |
| (235d)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    | (235d) |
| Annual totals kWh/year                                                                               |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Space heating fuel - main system 1                                                                   |         |         |         |         |         |         |         |         |         |         |         | 4503.9780 | (211)  |
| Space heating fuel - main system 2                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |         |         |         |         |         |         |         |         |         |         |         | 80.0000   |        |
| Water heating fuel used                                                                              |         |         |         |         |         |         |         |         |         |         |         | 2049.4258 | (219)  |
| Space cooling fuel                                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |         |         |         |         |         |         |         |         |         |         |         |           |        |
| central heating pump                                                                                 |         |         |         |         |         |         |         |         |         |         |         | 41.0000   | (230c) |
| main heating flue fan                                                                                |         |         |         |         |         |         |         |         |         |         |         | 45.0000   | (230e) |
| maintaining electric keep-hot facility for gas combi boiler                                          |         |         |         |         |         |         |         |         |         |         |         | 600.0000  | (230f) |
| Total electricity for the above, kWh/year                                                            |         |         |         |         |         |         |         |         |         |         |         | 686.0000  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |         |         |         |         |         |         |         |         |         |         | 169.8411  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| PV generation                                                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (233)  |
| Wind generation                                                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |         |         |         |         |         |         |         |         |         |         |         |           |        |
| Energy saved or generated                                                                            |         |         |         |         |         |         |         |         |         |         |         | -0.0000   | (236)  |
| Energy used                                                                                          |         |         |         |         |         |         |         |         |         |         |         | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |         |         |         |         |         |         |         |         |         |         |         | 7409.2449 | (238)  |

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                   | 4503.9780          | 0.2100                        | 945.8354                 | (261) |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                      | 2049.4258          | 0.2100                        | 430.3794                 | (264) |
| Space and water heating                         |                    |                               | 1376.2148                | (265) |
| Pumps, fans and electric keep-hot               | 686.0000           | 0.1387                        | 95.1567                  | (267) |
| Energy for lighting                             | 169.8411           | 0.1443                        | 24.5133                  | (268) |
| Total CO2, kg/year                              |                    |                               | 1495.8848                | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 25.9200                  | (273) |

13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 4503.9780          | 1.1300                              | 5089.4951                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2049.4258          | 1.1300                              | 2315.8512                  | (278) |
| Space and water heating                     |                    |                                     | 7405.3463                  | (279) |
| Pumps, fans and electric keep-hot           | 686.0000           | 1.5128                              | 1037.7808                  | (281) |
| Energy for lighting                         | 169.8411           | 1.5338                              | 260.5080                   | (282) |
| Total Primary energy kWh/year               |                    |                                     | 8703.6351                  | (286) |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 150.7900                   | (287) |

1. Overall dwelling characteristics

| Area<br>(m2) | Storey height<br>(m) | Volume<br>(m3) |
|--------------|----------------------|----------------|
|--------------|----------------------|----------------|

Ground floor

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)

Dwelling volume

57.7200

57.7200 (1b)

x

2.6500 (2b)

=

152.9580 (1b) -

(4)

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =

152.9580 (5)

2. Ventilation rate

Number of open chimneys

Number of flues attached to solid fuel boiler

Number of flues attached to other heater

Number of blocked chimneys

Number of intermittent extract fans

Number of passive vents

Number of flueless gas fires

0 \* 80 =

0 \* 20 =

0 \* 10 =

0 \* 20 =

0 \* 35 =

0 \* 20 =

2 \* 10 =

0 \* 10 =

0 \* 40 =

0.0000 (6a)

0.0000 (6b)

0.0000 (6c)

0.0000 (6d)

0.0000 (6e)

0.0000 (6f)

20.0000 (7a)

0.0000 (7b)

0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =

Pressure test

Pressure Test Method

Measured/design AP50

Infiltration rate

Number of sides sheltered

Air changes per hour

20.0000 / (5) =

Yes

Blower Door

5.0000 (17)

0.3808 (18)

0 (19)

Shelter factor

Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] =

(21) = (18) x (20) =

1.0000 (20)

0.3808 (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 | 0.4855 | 0.4759 | 0.4664 | 0.4188 | 0.4093 | 0.3617 | 0.3617 | 0.3522 | 0.3808 | 0.4093 | 0.4283 | 0.4474 (22b) |
| Effective ac    | 0.6178 | 0.6133 | 0.6088 | 0.5877 | 0.5838 | 0.5654 | 0.5654 | 0.5620 | 0.5725 | 0.5838 | 0.5917 | 0.6001 (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

TER Opening Type (Uw = 1.20)

PROPOSED GF

EXISTING EW

PROPOSED EW

PROPOSED FR

Total net area of external elements Aum(A, m2)

Fabric heat loss, W/K = Sum (A x U)

Party Wall

2.0300

12.4000

57.7200

9.5000

25.3300

9.7600

116.7400

(26)...(30) + (32) =

51.0400

1.0000

1.1450

0.1300

0.1800

0.1800

0.1100

0.0000

0.0000

2.0300

14.1985

7.5036

1.7100

4.5594

1.0736

31.0751

0.0000

(26)

(27)

(28a)

(29a)

(29a)

(30)

(31)

(33)

(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

K1 Element

E2 Other lintels (including other steel lintels)

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

328.9080 (35)

Length 35.0000

Psi-value 0.0500

Total 1.7500

1.7500 (36)

(36a) = 0.0000

(33) + (36) + (36a) = 32.8251 (37)

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

(38)m

Heat transfer coeff

Average = Sum(39)m / 12 =

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

31.1860

30.9551

30.7287

29.6653

29.4664

28.5402

28.5402

28.3687

28.8969

29.4664

29.8688

30.2896 (38)

64.0111

63.7801

63.5537

62.4904

62.2914

61.3653

61.3653

61.1938

61.7220

62.2914

62.6939

63.1147 (39)

62.4894

HLP

HLP (average)

Days in mont

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

1.1090

1.1050

1.1011

1.0826

1.0792

1.0632

1.0632

1.0602

1.0693

1.0792

1.0862

1.0935 (40)

1.0826

31

28

31

30

31

30

31

31

30

31

30

4. Water heating energy requirements (kWh/year)

Assumed occupancy

Hot water usage for mixer showers

Hot water usage for baths

Hot water usage for other uses

Average daily hot water use (litres/day)

1.9165 (42)

56.3528

24.3568

34.2568

55.5059

23.9950

33.0111

54.2719

23.4857

31.7654

51.9107

22.5464

30.5197

50.1683

21.8431

29.2740

48.2251

21.0633

28.0283

47.1206

20.6421

28.0283

48.3453

21.1479

29.2740

49.6878

21.6987

30.5197

51.7742

22.5331

31.7654

54.1861

23.4917

33.0111

56.1369 (42a)

24.2744 (42b)

34.2568 (42c)

105.6805 (43)

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

|                                                                                     |                                        |          |                          |          |                             |          |                              |          |                           |          |              |                |
|-------------------------------------------------------------------------------------|----------------------------------------|----------|--------------------------|----------|-----------------------------|----------|------------------------------|----------|---------------------------|----------|--------------|----------------|
| Daily hot water use                                                                 |                                        |          |                          |          |                             |          |                              |          |                           |          |              |                |
| Energy content (annual)                                                             | 114.9664                               | 112.5121 | 109.5229                 | 104.9768 | 101.2854                    | 97.3167  | 95.7909                      | 98.7672  | 101.9062                  | 106.0727 | 110.6888     | 114.6681 (44)  |
| Distribution loss (46)m = 0.15 x (45)m                                              | 182.0786                               | 160.2157 | 168.3326                 | 143.7080 | 136.3496                    | 119.6622 | 115.8508                     | 122.2944 | 125.6605                  | 143.9396 | 157.6965     | 179.5426 (45)  |
| Total storage loss                                                                  | 27.3118                                | 24.0324  | 25.2499                  | 21.5562  | 20.4524                     | 17.9493  | 17.3776                      | 18.3442  | 18.8491                   | 21.5909  | 23.6545      | 26.9314 (46)   |
| 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 (56)    |
| 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 (57)    |
| Combi loss                                                                          | 50.9589                                | 46.0274  | 50.9589                  | 49.3151  | 50.9589                     | 47.9918  | 48.8140                      | 50.3307  | 49.3151                   | 50.9589  | 49.3151      | 50.9589 (59)   |
| heating calculated for each month                                                   |                                        |          |                          |          |                             |          |                              |          |                           |          |              |                |
| WWHRS                                                                               | -25.7622                               | -22.7843 | -23.8584                 | -19.7557 | -18.4116                    | -15.7549 | -14.7677                     | -15.7040 | -16.3006                  | -19.2167 | -21.7701     | -25.2851 (62)  |
| PV diverter                                                                         | -0.0000                                | -0.0000  | -0.0000                  | -0.0000  | -0.0000                     | -0.0000  | -0.0000                      | -0.0000  | -0.0000                   | -0.0000  | -0.0000      | -0.0000 (63a)  |
| 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 (63b)   |
| FGHRS                                                                               | 0.0000                                 | 0.0000   | 0.0000                   | 0.0000   | 0.0000                      | 0.0000   | 0.0000                       | 0.0000   | 0.0000                    | 0.0000   | 0.0000       | 0.0000 (63c)   |
| Output from w/h                                                                     | 207.2754                               | 183.4588 | 195.4332                 | 173.2674 | 168.8969                    | 151.8990 | 149.8971                     | 156.9211 | 158.6749                  | 175.6819 | 185.2415     | 205.2164 (64)  |
| Total per year (kWh/year)                                                           | Total per year (kWh/year) = Sum(64)m = |          |                          |          |                             |          |                              |          |                           |          |              | 2111.8636 (64) |
| Electric shower(s)                                                                  | 0.0000                                 | 0.0000   | 0.0000                   | 0.0000   | 0.0000                      | 0.0000   | 0.0000                       | 0.0000   | 0.0000                    | 0.0000   | 0.0000       | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =      |                                        |          |                          |          |                             |          |                              |          |                           |          |              | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                            | 73.2809                                | 64.7786  | 68.7103                  | 60.1117  | 58.0760                     | 51.7856  | 50.7239                      | 53.2456  | 54.1109                   | 60.5997  | 64.7629      | 72.4376 (65)   |
| 5. Internal gains (see Table 5 and 5a)                                              |                                        |          |                          |          |                             |          |                              |          |                           |          |              |                |
| Metabolic gains (Table 5), Watts                                                    |                                        |          |                          |          |                             |          |                              |          |                           |          |              |                |
| (66)m                                                                               | 95.8246                                | 95.8246  | 95.8246                  | 95.8246  | 95.8246                     | 95.8246  | 95.8246                      | 95.8246  | 95.8246                   | 95.8246  | 95.8246      | 95.8246 (66)   |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 84.4278                                | 93.4736  | 84.4278                  | 87.2420  | 84.4278                     | 87.2420  | 84.4278                      | 84.4278  | 87.2420                   | 84.4278  | 87.2420      | 84.4278 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 167.1623                               | 168.8970 | 164.5258                 | 155.2200 | 143.4732                    | 132.4328 | 125.0572                     | 123.3225 | 127.6937                  | 136.9995 | 148.7463     | 159.7867 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 32.5825                                | 32.5825  | 32.5825                  | 32.5825  | 32.5825                     | 32.5825  | 32.5825                      | 32.5825  | 32.5825                   | 32.5825  | 32.5825      | 32.5825 (69)   |
| Pumps, fans                                                                         | 3.0000                                 | 3.0000   | 3.0000                   | 3.0000   | 3.0000                      | 0.0000   | 0.0000                       | 0.0000   | 0.0000                    | 3.0000   | 3.0000       | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -76.6597                               | -76.6597 | -76.6597                 | -76.6597 | -76.6597                    | -76.6597 | -76.6597                     | -76.6597 | -76.6597                  | -76.6597 | -76.6597     | -76.6597 (71)  |
| Water heating gains (Table 5)                                                       | 98.4958                                | 96.3967  | 92.3526                  | 83.4885  | 78.0591                     | 71.9245  | 68.1773                      | 71.5666  | 75.1540                   | 81.4512  | 89.9484      | 97.3624 (72)   |
| Total internal gains                                                                | 404.8333                               | 413.5146 | 396.0535                 | 380.6979 | 360.7074                    | 343.3467 | 329.4096                     | 331.0643 | 341.8371                  | 357.6258 | 380.6841     | 396.3242 (73)  |
| 6. Solar gains                                                                      |                                        |          |                          |          |                             |          |                              |          |                           |          |              |                |
| [Jan]                                                                               | Area m2                                |          | Solar flux Table 6a W/m2 |          | Specific data g or Table 6b |          | Specific data FF or Table 6c |          | Access factor Table 6d    |          | Gains W      |                |
| Northeast                                                                           | 0.2500                                 |          | 11.2829                  |          | 0.6300                      |          | 0.7000                       |          | 0.7700                    |          | 0.8621 (75)  |                |
| Southeast                                                                           | 4.1100                                 |          | 36.7938                  |          | 0.6300                      |          | 0.7000                       |          | 0.7700                    |          | 46.2156 (77) |                |
| Southwest                                                                           | 3.3100                                 |          | 36.7938                  |          | 0.6300                      |          | 0.7000                       |          | 0.7700                    |          | 37.2199 (79) |                |
| Northwest                                                                           | 4.7300                                 |          | 11.2829                  |          | 0.6300                      |          | 0.7000                       |          | 0.7700                    |          | 16.3100 (81) |                |
| Solar gains                                                                         | 100.6076                               | 177.0758 | 257.4334                 | 344.3670 | 408.8988                    | 416.1375 | 396.9580                     | 347.2557 | 287.2935                  | 199.7915 | 121.5434     | 85.4270 (83)   |
| Total gains                                                                         | 505.4408                               | 590.5904 | 653.4869                 | 725.0649 | 769.6062                    | 759.4842 | 726.3675                     | 678.3199 | 629.1306                  | 557.4172 | 502.2276     | 481.7512 (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 from living area, nil,m (see Table 9a)                 |                                        |          |                          |          |                             |          |                              |          |                           |          |              |                |
| tau                                                                                 | 82.3840                                | 82.6824  | 82.9769                  | 84.3889  | 84.6584                     | 85.9361  | 85.9361                      | 86.1769  | 85.4394                   | 84.6584  | 84.1149      | 83.5541        |
| alpha                                                                               | 6.4923                                 | 6.5122   | 6.5318                   | 6.6259   | 6.6439                      | 6.7291   | 6.7291                       | 6.7451   | 6.6960                    | 6.6439   | 6.6077       | 6.5703         |
| util living area                                                                    | 0.9959                                 | 0.9882   | 0.9667                   | 0.8864   | 0.7209                      | 0.5141   | 0.3714                       | 0.4143   | 0.6601                    | 0.9247   | 0.9887       | 0.9969 (86)    |
| MIT                                                                                 | 20.1543                                | 20.3369  | 20.5662                  | 20.8297  | 20.9632                     | 20.9966  | 20.9997                      | 20.9993  | 20.9840                   | 20.8012  | 20.4376      | 20.1307 (87)   |
| Th 2                                                                                | 19.9935                                | 19.9968  | 20.0000                  | 20.0150  | 20.0179                     | 20.0310  | 20.0310                      | 20.0335  | 20.0260                   | 20.0179  | 20.0121      | 20.0062 (88)   |
| util rest of house                                                                  | 0.9942                                 | 0.9836   | 0.9538                   | 0.8495   | 0.6566                      | 0.4379   | 0.2898                       | 0.3277   | 0.5748                    | 0.8903   | 0.9834       | 0.9957 (89)    |
| MIT 2                                                                               | 19.0302                                | 19.2634  | 19.5492                  | 19.8635  | 19.9931                     | 20.0296  | 20.0310                      | 20.0333  | 20.0180                   | 19.8437  | 19.4045      | 19.0101 (90)   |
| Living area fraction                                                                | 19.4992                                | 19.7112  | 19.9734                  | 20.2666  | 20.3978                     | 20.4330  | 20.4351                      | 20.4363  | fLA = Living area / (4) = | 20.4210  | 19.8355      | 0.4172 (91)    |
| MIT                                                                                 | 19.4992                                | 19.7112  | 19.9734                  | 20.2666  | 20.3978                     | 20.4330  | 20.4351                      | 20.4363  | 20.4210                   | 20.2431  | 19.8355      | 19.4776 (92)   |
| Temperature adjustment                                                              | 19.4992                                | 19.7112  | 19.9734                  | 20.2666  | 20.3978                     | 20.4330  | 20.4351                      | 20.4363  | 20.4210                   | 20.2431  | 19.8355      | 0.0000         |
| adjusted MIT                                                                        | 19.4992                                | 19.7112  | 19.9734                  | 20.2666  | 20.3978                     | 20.4330  | 20.4351                      | 20.4363  | 20.4210                   | 20.2431  | 19.8355      | 19.4776 (93)   |

8. Space heating requirement

Full SAP Calculation Printout 

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 %)                      | 92.4000 | (206) |
| Efficiency of main space heating system 2 (in %)                      | 0.0000  | (207) |
| Efficiency of secondary/supplementary heating system, %               | 0.0000  | (208) |

[illegible][illegible]

|                                                     |                |
|-----------------------------------------------------|----------------|
| Electricity for pumps and fans:                     |                |
| Total electricity for the above, kWh/year           | 86.0000 (231)  |
| Electricity for lighting (calculated in Appendix L) | 141.5774 (232) |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -713.2389 (233) |
| Wind generation                                               | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                        | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (235)    |
| Appendix Q - special features                                 |                 |
| Energy saved or generated                                     | -0.0000 (236)   |
| Energy used                                                   | 0.0000 (237)    |
| Total delivered energy for all uses                           | 3685.7278 (238) |

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 1621.8989          | 0.2100                        | 340.5988 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2549.4905          | 0.2100                        | 535.3930 (264)           |
| Space and water heating                       |                    |                               | 875.9918 (265)           |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 141.5774           | 0.1443                        | 20.4340 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -383.2260          | 0.1335                        | -51.1580                 |
| PV Unit electricity exported                  | -330.0129          | 0.1253                        | -41.3608                 |
| Total                                         |                    |                               | -92.5189 (269)           |
| Total CO2, kg/year                            |                    |                               | 815.8361 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 14.1300 (273)            |

13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1621.8989          | 1.1300                              | 1832.7457 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2549.4905          | 1.1300                              | 2880.9242 (278)            |
| Space and water heating                     |                    |                                     | 4713.6700 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 141.5774           | 1.5338                              | 217.1561 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -383.2260          | 1.4933                              | -572.2735                  |
| PV Unit electricity exported                | -330.0129          | 0.4600                              | -151.8140                  |
| Total                                       |                    |                                     | -724.0875 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 4336.8394 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 75.1400 (287)              |



|                                     |                      |         |                         |
|-------------------------------------|----------------------|---------|-------------------------|
| Fabric heat loss, W/K = Sum (A x U) | (26)...(30) + (32) = | 44.3070 | (33)                    |
| Party Wall                          | 69.2500              | 0.0000  | 45.0000                 |
| PF                                  | 48.9900              |         | 3116.2500 (32)          |
| PC                                  | 42.7000              |         | 40.0000 1959.6000 (32d) |
| Internal Wall 1                     | 132.1000             |         | 30.0000 1281.0000 (32b) |
| Internal Floor 1                    | 3.5000               |         | 75.0000 9907.5000 (32c) |
| Internal Ceiling 1                  | 3.5000               |         | 18.0000 63.0000 (32d)   |
|                                     |                      |         | 9.0000 31.5000 (32e)    |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19384.3600 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 346.2730 (35)

|                                                  |         |           |                                    |
|--------------------------------------------------|---------|-----------|------------------------------------|
| List of Thermal Bridges                          | Length  | Psi-value | Total                              |
| K1 Element                                       | 24.1000 | 0.5000    | 12.0500                            |
| E2 Other lintels (including other steel lintels) |         |           | 12.0500 (36)                       |
| calculated using Appendix K)                     |         |           | 0.0000                             |
| Total fabric heat loss                           |         |           | (33) + (36) + (36a) = 56.3570 (37) |

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| (38)m                                                               | 64.7779  | 63.5078  | 62.2376  | 55.9660  | 54.7754  | 49.2327  | 49.2327  | 48.2063  | 51.3677  | 54.7754  | 57.1840  | 59.6973 (38)  |
| Heat transfer coeff                                                 | 121.1350 | 119.8648 | 118.5946 | 112.3230 | 111.1324 | 105.5897 | 105.5897 | 104.5633 | 107.7247 | 111.1324 | 113.5410 | 116.0543 (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 112.2704      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 2.1639   | 2.1412   | 2.1185   | 2.0065   | 1.9852   | 1.8862   | 1.8862   | 1.8679   | 1.9243   | 1.9852   | 2.0282   | 2.0731 (40)   |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

#### 4. Water heating energy requirements (kWh/year)

|                                                                 |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy                                               |                                                                                |          |          |          |          |          |          |          |          |          |          | 1.8660 (42)    |
| Hot water usage for mixer showers                               | 55.5064                                                                        | 54.6722  | 53.4567  | 51.1310  | 49.4147  | 47.5007  | 46.4128  | 47.6191  | 48.9415  | 50.9966  | 53.3722  | 55.2937 (42a)  |
| Hot water usage for baths                                       | 23.9928                                                                        | 23.6365  | 23.1347  | 22.2095  | 21.5167  | 20.7485  | 20.3336  | 20.8319  | 21.3744  | 22.1964  | 23.1406  | 23.9117 (42b)  |
| Hot water usage for other uses                                  | 33.7398                                                                        | 32.5129  | 31.2860  | 30.0591  | 28.8322  | 27.6053  | 27.6053  | 28.8322  | 30.0591  | 31.2860  | 32.5129  | 33.7398 (42c)  |
| Average daily hot water use (litres/day)                        |                                                                                |          |          |          |          |          |          |          |          |          |          | 104.0927 (43)  |
| Daily hot water use                                             | Jan                                                                            | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
|                                                                 | 113.2390                                                                       | 110.8216 | 107.8774 | 103.3996 | 99.7637  | 95.8546  | 94.3517  | 97.2832  | 100.3750 | 104.4789 | 109.0257 | 112.9452 (44)  |
| Energy content (annual)                                         | 179.3429                                                                       | 157.8085 | 165.8036 | 141.5489 | 134.3011 | 117.8644 | 114.1102 | 120.4570 | 123.7724 | 141.7769 | 155.3272 | 176.8449 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                          | 26.9014                                                                        | 23.6713  | 24.8705  | 21.2323  | 20.1452  | 17.6797  | 17.1165  | 18.0685  | 18.5659  | 21.2665  | 23.2991  | 26.5267 (46)   |
| Water storage loss:                                             |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
| Total storage loss                                              | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Primary loss                                                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                      | 50.9589                                                                        | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589 (61)   |
| Total heat required for water heating calculated for each month | 230.3018                                                                       | 203.8359 | 216.7625 | 190.8640 | 185.2600 | 167.1795 | 165.0691 | 171.4159 | 173.0875 | 192.7358 | 204.6422 | 227.8038 (62)  |
| WWHRS                                                           | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63a)   |
| PV diverter                                                     | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)   |
| 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 (63c)   |
| FGHRS                                                           | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                 | 230.3018                                                                       | 203.8359 | 216.7625 | 190.8640 | 185.2600 | 167.1795 | 165.0691 | 171.4159 | 173.0875 | 192.7358 | 204.6422 | 227.8038 (64)  |
| 12Total per year (kWh/year)                                     | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 2328.9580 (64) |
| Electric shower(s)                                              |                                                                                |          |          |          |          |          |          |          |          |          |          | 2329 (64)      |
|                                                                 | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                                                 | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 72.3712                                                                        | 63.9782  | 67.8694  | 59.3938  | 57.3948  | 51.5187  | 50.6814  | 52.7917  | 53.4831  | 59.8806  | 63.9750  | 71.5407 (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                                                                               | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 82.0672  | 90.8601  | 82.0672  | 84.8027  | 82.0672  | 84.8027  | 82.0672  | 82.0672  | 84.8027  | 82.0672  | 84.8027  | 82.0672 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 162.7073 | 164.3957 | 160.1410 | 151.0833 | 139.6495 | 128.9034 | 121.7243 | 120.0359 | 124.2906 | 133.3483 | 144.7821 | 155.5282 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404 (71) |
| Water heating gains (Table 5)                                                       | 97.2732  | 95.2056  | 91.2223  | 82.4914  | 77.1436  | 71.5537  | 68.1201  | 70.9565  | 74.2821  | 80.4846  | 88.8542  | 96.1568 (72)  |
| Total internal gains                                                                | 396.0378 | 404.4516 | 387.4207 | 372.3675 | 352.8504 | 336.2500 | 322.9017 | 324.0498 | 334.3656 | 349.8903 | 372.4292 | 387.7424 (73) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 134.4395 | 242.9162 | 369.3322 | 519.5772 | 638.5209 | 658.7785 | 624.7809 | 532.2406 | 420.7628 | 278.4405 | 163.5617 | 113.4123 (83) |
| Total gains | 530.4773 | 647.3678 | 756.7529 | 891.9447 | 991.3713 | 995.0284 | 947.6826 | 856.2903 | 755.1284 | 628.3308 | 535.9910 | 501.1547 (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,  $ni_{1,m}$  (see Table 9a)

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

|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| tau                    | 44.4508 | 44.9218 | 45.4029 | 47.9380 | 48.4516 | 50.9950 | 50.9950 | 51.4955 | 49.9843                   | 48.4516 | 47.4238 | 46.3968      |
| alpha                  | 3.9634  | 3.9948  | 4.0269  | 4.1959  | 4.2301  | 4.3997  | 4.3997  | 4.4330  | 4.3323                    | 4.2301  | 4.1616  | 4.0931       |
| util living area       | 0.9963  | 0.9915  | 0.9791  | 0.9339  | 0.8253  | 0.6338  | 0.4792  | 0.5418  | 0.8060                    | 0.9639  | 0.9926  | 0.9971 (86)  |
| MIT                    | 19.4808 | 19.6771 | 19.9742 | 20.4090 | 20.7146 | 20.8847 | 20.9192 | 20.9131 | 20.7948                   | 20.3845 | 19.8997 | 19.5104 (87) |
| Th 2                   | 19.2263 | 19.2409 | 19.2555 | 19.3290 | 19.3432 | 19.4103 | 19.4103 | 19.4229 | 19.3842                   | 19.3432 | 19.3146 | 19.2850 (88) |
| util rest of house     | 0.9945  | 0.9873  | 0.9683  | 0.8996  | 0.7417  | 0.4971  | 0.3118  | 0.3663  | 0.6838                    | 0.9377  | 0.9882  | 0.9957 (89)  |
| MIT 2                  | 17.5416 | 17.8016 | 18.1864 | 18.7689 | 19.1051 | 19.3031 | 19.3185 | 19.3303 | 19.2252                   | 18.7656 | 18.1405 | 17.6218 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4411 (91)  |
| MIT                    | 18.3969 | 18.6288 | 18.9749 | 19.4922 | 19.8150 | 20.0007 | 20.0245 | 20.0284 | 19.9175                   | 19.4796 | 18.9164 | 18.4547 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | -0.1500      |
| adjusted MIT           | 18.2469 | 18.4788 | 18.8249 | 19.3422 | 19.6650 | 19.8507 | 19.8745 | 19.8784 | 19.7675                   | 19.3296 | 18.7664 | 18.3047 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9930    | 0.9847    | 0.9647    | 0.9000    | 0.7604   | 0.5375   | 0.3621   | 0.4192   | 0.7176   | 0.9375        | 0.9861    | 0.9945 (94)    |
| Useful gains                                                                   | 526.7749  | 637.4644  | 730.0134  | 802.7155  | 753.8471 | 534.8549 | 343.1427 | 358.9664 | 541.8791 | 589.0292      | 528.5299  | 498.4119 (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                                                               |           |           |           |           |          |          |          |          |          |               |           |                |
| Space heating kWh                                                              | 1689.4542 | 1627.6168 | 1461.6682 | 1172.9032 | 885.1639 | 554.4169 | 345.7545 | 363.7120 | 610.5291 | 970.1417      | 1324.6185 | 1636.9150 (97) |
| Space heating requirement - total per year (kWh/year)                          | 865.0334  | 665.3824  | 544.3512  | 266.5352  | 97.6997  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 283.5477      | 573.1838  | 847.0463 (98a) |
| Solar heating kWh                                                              |           |           |           |           |          |          |          |          |          |               |           | 4142.7798      |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Space heating kWh                                                              |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating requirement after solar contribution - total per year (kWh/year) | 865.0334  | 665.3824  | 544.3512  | 266.5352  | 97.6997  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 283.5477      | 573.1838  | 847.0463 (98c) |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |               |           | 4142.7798      |
|                                                                                |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 74.0046 (99)   |

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 secondary (supplemental) 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 %) | 92.3000 (206) |
|--------------------------------------------------|---------------|

|                                                  |              |
|--------------------------------------------------|--------------|
| Efficiency of main space heating system 2 (in %) | 0.0000 (207) |
|--------------------------------------------------|--------------|

|                                                         |              |
|---------------------------------------------------------|--------------|
| Efficiency of secondary/supplementary heating system, % | 0.0000 (208) |
|---------------------------------------------------------|--------------|

[illegible]

Water heating

Water heating requirement

|                            |          |          |          |          |          |          |          |          |          |          |          |               |
|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Water heating requirements | 230.3018 | 203.8359 | 216.7625 | 190.8640 | 185.2600 | 167.1795 | 165.0691 | 171.4159 | 173.0875 | 192.7358 | 204.6422 | 227.8038 (64) |
|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|

|                            |               |
|----------------------------|---------------|
| Efficiency of water heater | 80.0000 (216) |
|----------------------------|---------------|



[illegible]

|                                                                                     |          |          |          |          |            |          |          |               |          |          |          |                |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|------------|----------|----------|---------------|----------|----------|----------|----------------|
|                                                                                     | 33.7398  | 32.5129  | 31.2860  | 30.0591  | 28.8322    | 27.6053  | 27.6053  | 28.8322       | 30.0591  | 31.2860  | 32.5129  | 33.7398 (42c)  |
| Average daily hot water use (litres/day)                                            |          |          |          |          |            |          |          |               |          |          |          | 104.0927 (43)  |
| Daily hot water use                                                                 | Jan      | Feb      | Mar      | Apr      | May        | Jun      | Jul      | Aug           | Sep      | Oct      | Nov      | Dec            |
| Energy content (annual)                                                             | 113.2390 | 110.8216 | 107.8774 | 103.3996 | 99.7637    | 95.8546  | 94.3517  | 97.2832       | 100.3750 | 104.4789 | 109.0257 | 112.9452 (44)  |
| Distribution loss (46)m = 0.15 x (45)m                                              | 179.3429 | 157.8085 | 165.8036 | 141.5489 | 134.3011   | 117.8644 | 114.1102 | 120.4570      | 123.7724 | 141.7769 | 155.3272 | 176.8449 (45)  |
| Water storage loss:                                                                 | 26.9014  | 23.6713  | 24.8705  | 21.2323  | 20.1452    | 17.6797  | 17.1165  | 18.0685       | 18.5659  | 21.2665  | 23.2991  | 26.5267 (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)    |
| 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 (57)    |
| Combi loss                                                                          | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.8385    | 47.2707  | 48.0806  | 49.5745       | 49.3151  | 50.9589  | 49.3151  | 50.9589 (61)   |
| Total heat required for water heating calculated for each month                     | 230.3018 | 203.8359 | 216.7625 | 190.8640 | 185.1395   | 165.1351 | 162.1908 | 170.0314      | 173.0875 | 192.7358 | 204.6422 | 227.8038 (62)  |
| WWHRS                                                                               | -25.3752 | -22.4420 | -23.5000 | -19.4589 | -18.1350   | -15.5183 | -14.5459 | -15.4681      | -16.0558 | -18.9280 | -21.4432 | -24.9053 (63a) |
| PV diverter                                                                         | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000    | -0.0000  | -0.0000  | -0.0000       | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| 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 (63c)   |
| FGHRS                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                     | 204.9266 | 181.3939 | 193.2625 | 171.4051 | 167.0045   | 149.6169 | 147.6449 | 154.5633      | 157.0317 | 173.8078 | 183.1991 | 202.8985 (64)  |
| 12Total per year (kWh/year)                                                         |          |          |          |          |            |          |          |               |          |          |          | 2086.7547 (64) |
| Electric shower(s)                                                                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =      |          |          |          |          |            |          |          |               |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                            | 72.3712  | 63.9782  | 67.8694  | 59.3938  | 57.3647    | 51.0076  | 49.9618  | 52.4456       | 53.4831  | 59.8806  | 63.9750  | 71.5407 (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                                                                               | 93.3005  | 93.3005  | 93.3005  | 93.3005  | 93.3005    | 93.3005  | 93.3005  | 93.3005       | 93.3005  | 93.3005  | 93.3005  | 93.3005 (66)   |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 82.2024  | 91.0098  | 82.2024  | 84.9424  | 82.2024    | 84.9424  | 82.2024  | 82.2024       | 84.9424  | 82.2024  | 84.9424  | 82.2024 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 162.7073 | 164.3957 | 160.1410 | 151.0833 | 139.6495   | 128.9034 | 121.7243 | 120.0359      | 124.2906 | 133.3483 | 144.7821 | 155.5282 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 32.3301  | 32.3301  | 32.3301  | 32.3301  | 32.3301    | 32.3301  | 32.3301  | 32.3301       | 32.3301  | 32.3301  | 32.3301  | 32.3301 (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)                                 | -74.6404 | -74.6404 | -74.6404 | -74.6404 | -74.6404   | -74.6404 | -74.6404 | -74.6404      | -74.6404 | -74.6404 | -74.6404 | -74.6404 (71)  |
| Water heating gains (Table 5)                                                       | 97.2732  | 95.2056  | 91.2223  | 82.4914  | 77.1031    | 70.8439  | 67.1530  | 70.4913       | 74.2821  | 80.4846  | 88.8542  | 96.1568 (72)   |
| Total internal gains                                                                | 396.1730 | 404.6013 | 387.5559 | 372.5072 | 352.9451   | 335.6798 | 322.0698 | 323.7198      | 334.5053 | 350.0255 | 372.5689 | 387.8776 (73)  |
| -----                                                                               |          |          |          |          |            |          |          |               |          |          |          |                |
| 6. Solar gains                                                                      |          |          |          |          |            |          |          |               |          |          |          |                |
| -----                                                                               |          |          |          |          |            |          |          |               |          |          |          |                |
| [Jan]                                                                               |          |          |          | Area     | Solar flux |          | g        | FF            |          | Access   |          | Gains          |
|                                                                                     |          |          |          | m2       | Table 6a   |          | W/m2     | Specific data |          | factor   |          | W              |
|                                                                                     |          |          |          |          |            |          |          | or Table 6b   |          | Table 6d |          |                |
| Northeast                                                                           |          |          |          | 7.1300   | 11.2829    |          | 0.6300   | 0.7000        |          | 0.7700   |          | 24.5858 (75)   |
| Southeast                                                                           |          |          |          | 2.9100   | 36.7938    |          | 0.6300   | 0.7000        |          | 0.7700   |          | 32.7220 (77)   |
| Southwest                                                                           |          |          |          | 1.9200   | 36.7938    |          | 0.6300   | 0.7000        |          | 0.7700   |          | 21.5898 (79)   |
| -----                                                                               |          |          |          |          |            |          |          |               |          |          |          |                |
| Solar gains                                                                         | 78.8975  | 142.5581 | 216.7456 | 304.9164 | 374.7178   | 386.6055 | 366.6542 | 312.3475      | 246.9275 | 163.4056 | 95.9882  | 66.5575 (83)   |
| Total gains                                                                         | 475.0706 | 547.1593 | 604.3015 | 677.4237 | 727.6630   | 722.2853 | 688.7239 | 636.0673      | 581.4328 | 513.4311 | 468.5572 | 454.4351 (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                                                                                 | 86.3236  | 86.6549  | 86.9821  | 88.5529  | 88.8531    | 90.2778  | 90.2778  | 90.5467       | 89.7236  | 88.8531  | 88.2479  | 87.6239        |
| alpha                                                                               | 6.7549   | 6.7770   | 6.7988   | 6.9035   | 6.9235     | 7.0185   | 7.0185   | 7.0364        | 6.9816   | 6.9235   | 6.8832   | 6.8416         |
| util living area                                                                    | 0.9976   | 0.9932   | 0.9792   | 0.9142   | 0.7528     | 0.5368   | 0.3891   | 0.4388        | 0.7044   | 0.9494   | 0.9933   | 0.9982 (86)    |
| MIT                                                                                 | 20.1473  | 20.3081  | 20.5294  | 20.8077  | 20.9591    | 20.9965  | 20.9997  | 20.9993       | 20.9802  | 20.7728  | 20.4186  | 20.1297 (87)   |
| Th 2                                                                                | 19.9693  | 19.9728  | 19.9763  | 19.9926  | 19.9956    | 20.0099  | 20.0099  | 20.0125       | 20.0044  | 19.9956  | 19.9894  | 19.9830 (88)   |
| util rest of house                                                                  | 0.9965   | 0.9902   | 0.9699   | 0.8810   | 0.6862     | 0.4556   | 0.3018   | 0.3451        | 0.6140   | 0.9214   | 0.9897   | 0.9974 (89)    |
| MIT 2                                                                               | 18.9958  | 19.2028  | 19.4820  | 19.8204  | 19.9687    | 20.0085  | 20.0098  | 20.0124       | 19.9948  | 19.7931  | 19.3574  | 18.9841 (90)   |
| Living area fraction                                                                | 19.5037  | 19.6903  | 19.9440  | 20.2559  | 20.4055    | 20.4443  | 20.4464  | 20.4477       | 20.4294  | 20.2252  | 19.8254  | 19.4894 (92)   |
| MIT                                                                                 |          |          |          |          |            |          |          |               |          |          |          | 0.0000         |
| Temperature adjustment                                                              |          |          |          |          |            |          |          |               |          |          |          | 0.0000         |
| adjusted MIT                                                                        | 19.5037  | 19.6903  | 19.9440  | 20.2559  | 20.4055    | 20.4443  | 20.4464  | 20.4477       | 20.4294  | 20.2252  | 19.8254  | 19.4894 (93)   |

## 8. Space heating requirement

Full SAP Calculation Printout 

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 %)                      | 92.4000 (206) |
| Efficiency of main space heating system 2 (in %)                      | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %               | 0.0000 (208)  |

[illegible]

|                           |  |
|---------------------------|--|
| Water heating             |  |
| Water heating requirement |  |

[illegible]

Electricity for pumps and fans:

|                                           |               |
|-------------------------------------------|---------------|
| Total electricity for the above, kWh/year | 86.0000 (231) |
|-------------------------------------------|---------------|

|                                                     |                |
|-----------------------------------------------------|----------------|
| Electricity for lighting (calculated in Appendix L) | 137.8456 (232) |
|-----------------------------------------------------|----------------|

## Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -691.7379 (233)

|                 |              |
|-----------------|--------------|
| Wind generation | 0.0000 (234) |
|-----------------|--------------|

|                                        |               |
|----------------------------------------|---------------|
| Hydro-electric generation (Appendix N) | 0.0000 (235a) |
|----------------------------------------|---------------|

|                                                |              |
|------------------------------------------------|--------------|
| Electricity generated - Micro CHP (Appendix N) | 0.0000 (235) |
|------------------------------------------------|--------------|

## Appendix Q - special features

|                           |               |
|---------------------------|---------------|
| Energy saved or generated | -0.0000 (236) |
|---------------------------|---------------|

|                                     |                 |
|-------------------------------------|-----------------|
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 3806.0821 (238) |

-----
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP
 -----

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 1759.1645          | 0.2100                        | 369.4246 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2514.8099          | 0.2100                        | 528.1101 (264)           |
| Energy for lighting                           | 86.0000            | 0.1387                        | 897.5346 (265)           |
| Energy saving/generation technologies         | 137.8456           | 0.1443                        | 11.9293 (267)            |
| PV Unit electricity used in dwelling          | -372.4157          | 0.1335                        | 19.8954 (268)            |
| PV Unit electricity exported                  | -319.3223          | 0.1253                        | -49.7117                 |
| Total                                         |                    |                               | -40.0206                 |
| Total CO2, kg/year                            |                    |                               | -89.7323 (269)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 839.6270 (272)           |
|                                               |                    |                               | 15.0000 (273)            |

-----
 13a. Primary energy - Individual heating systems including micro-CHP
 -----

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 1759.1645          | 1.1300                              | 1987.8559 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2514.8099          | 1.1300                              | 2841.7352 (278)            |
| Space and water heating                     |                    |                                     | 4829.5911 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 137.8456           | 1.5338                              | 211.4322 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -372.4157          | 1.4933                              | -556.1184                  |
| PV Unit electricity exported                | -319.3223          | 0.4600                              | -146.8946                  |
| Total                                       |                    |                                     | -703.0130 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 4468.1111 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 79.8200 (287)              |

|                                    |                 |               |                |             |           |
|------------------------------------|-----------------|---------------|----------------|-------------|-----------|
| Property Reference                 | Flat 7          |               | Issued on Date | 14/06/2023  |           |
| Assessment Reference               | Flat 7          | Prop Type Ref |                |             |           |
| Property                           |                 |               |                |             |           |
| SAP Rating                         | 77 C            | DER           | 21.12          | TER         | 11.28     |
| Environmental                      | 81 B            | % DER < TER   | -87.23         |             |           |
| CO <sub>2</sub> Emissions (t/year) | 1.6             | DFEE          | 66.77          | TFEE        | 31.13     |
| Compliance Check                   | See BREL        | % DFEE < TFEE | -114.52        |             |           |
| % DPER < TPER                      | -103.99         | DPER          | 121.29         | TPER        | 59.46     |
| Assessor Details                   | Mr. George Farr |               |                | Assessor ID | T355-0001 |

Energy Saving Calculations



SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 91.6600 (1b)              | x 2.5000 (2b)                   | = 229.1500 (1b) - (4)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 91.6600                   |                                 |                             |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 229.1500 (5)              |

2. Ventilation rate

|                                                    | m <sup>3</sup> per hour |
|----------------------------------------------------|-------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)    |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)    |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)    |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)    |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)    |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)    |
| Number of intermittent extract 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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour       |
| Pressure test                                        |                                                       | 30.0000 / (5) = 0.1309 (8) |
| Pressure Test Method                                 |                                                       | No                         |
| Measured/design AP50                                 |                                                       | Blower Door                |
| Infiltration rate                                    |                                                       | 15.0000 (17)               |
| Number of sides sheltered                            |                                                       | 0.8809 (18)                |
|                                                      |                                                       | 0 (19)                     |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 1.0000 (20)                |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.8809 (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 | 1.1232 | 1.1011 | 1.0791 | 0.9690 | 0.9470 | 0.8369 | 0.8369 | 0.8148 | 0.8809 | 0.9470 | 0.9910 | 1.0351 (22b) |
| Effective ac    | 1.1232 | 1.1011 | 1.0791 | 0.9695 | 0.9484 | 0.8502 | 0.8502 | 0.8320 | 0.8880 | 0.9484 | 0.9911 | 1.0351 (25)  |

3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| G (Uw = 1.60)                                               |                         |                            | 23.4900                   | 1.5038                        | 35.3233      |                                | (27)            |
| EXISTING EW                                                 | 26.8400                 | 17.5700                    | 9.2700                    | 0.3000                        | 2.7810       | 9.0000                         | 83.4300 (29a)   |
| PROPOSED EW                                                 | 35.6200                 | 5.9200                     | 29.7000                   | 0.1800                        | 5.3460       | 60.0000                        | 1782.0000 (29a) |
| SW                                                          | 13.5500                 |                            | 13.5500                   | 0.2400                        | 3.2520       | 9.0000                         | 121.9500 (29a)  |
| PROPOSED FR                                                 | 57.4400                 |                            | 57.4400                   | 0.1500                        | 8.6160       | 9.0000                         | 516.9600 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 133.4500                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 55.3183      |                                | (33)            |
| Party Wall                                                  |                         |                            | 41.1400                   | 0.0000                        | 0.0000       | 45.0000                        | 1851.3000 (32)  |

|                 |          |         |                 |
|-----------------|----------|---------|-----------------|
| PF              | 91.6600  | 40.0000 | 3666.4000 (32d) |
| PC              | 34.2200  | 30.0000 | 1026.6000 (32b) |
| Internal Wall 1 | 132.1000 | 75.0000 | 9907.5000 (32c) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18956.1400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 206.8093 (35)

|                                                            |         |           |                                    |
|------------------------------------------------------------|---------|-----------|------------------------------------|
| List of Thermal Bridges                                    | Length  | Psi-value | Total                              |
| K1 Element                                                 | 40.0000 | 0.5000    | 20.0000                            |
| E2 Other lintels (including other steel lintels)           |         |           | 20.0000 (36)                       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           | 0.0000                             |
| Point Thermal bridges                                      |         |           | (36a) =                            |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = 75.3183 (37) |

|                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
|------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Monthly Energy Calculation Summary | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| (38)m                              | 84.9336  | 83.2683  | 81.6029  | 73.3124  | 71.7170  | 64.2900  | 64.2900  | 62.9147  | 67.1508  | 71.7170  | 74.9445  | 78.2722  | (38) |
| Heat transfer coeff                | 160.2520 | 158.5866 | 156.9212 | 148.6307 | 147.0353 | 139.6083 | 139.6083 | 138.2330 | 142.4691 | 147.0353 | 150.2628 | 153.5905 | (39) |
| Average = Sum(39)m / 12 =          |          |          |          |          |          |          |          |          |          |          |          | 148.5194 |      |
| HLP                                | 1.7483   | 1.7302   | 1.7120   | 1.6215   | 1.6041   | 1.5231   | 1.5231   | 1.5081   | 1.5543   | 1.6041   | 1.6393   | 1.6757   | (40) |
| HLP (average)                      |          |          |          |          |          |          |          |          |          |          |          | 1.6203   |      |
| Days in mont                       | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |      |

4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.6478 (42) |
| Hot water usage for mixer showers                                              | 68.6141  | 67.5830  | 66.0804  | 63.2055  | 61.0839  | 58.7179  | 57.3731  | 58.8643  | 60.4989  | 63.0393  | 65.9759  | 68.3512   | (42a)       |
| Hot water usage for baths                                                      | 29.6295  | 29.1895  | 28.5698  | 27.4273  | 26.5717  | 25.6231  | 25.1107  | 25.7260  | 26.3960  | 27.4111  | 28.5772  | 29.5294   | (42b)       |
| Hot water usage for other uses                                                 | 41.7458  | 40.2278  | 38.7097  | 37.1917  | 35.6737  | 34.1556  | 34.1556  | 35.6737  | 37.1917  | 38.7097  | 40.2278  | 41.7458   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 128.6819  | (43)        |
| Daily hot water use                                                            | 139.9894 | 137.0002 | 133.3599 | 127.8245 | 123.3293 | 118.4966 | 116.6394 | 120.2640 | 124.0866 | 129.1601 | 134.7808 | 139.6264  | (44)        |
| Energy content (annual)                                                        | 221.7090 | 195.0865 | 204.9693 | 174.9853 | 166.0249 | 145.7054 | 141.0652 | 148.9119 | 153.0112 | 175.2690 | 192.0200 | 218.6211  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                                         | 33.2564  | 29.2630  | 30.7454  | 26.2478  | 24.9037  | 21.8558  | 21.1598  | 22.3368  | 22.9517  | 26.2903  | 28.8030  | 32.7932   | (46)        |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 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    | (57)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                | 272.6679 | 241.1139 | 255.9282 | 224.3004 | 216.9839 | 195.0205 | 192.0241 | 199.8708 | 202.3263 | 226.2279 | 241.3351 | 269.5800  | (62)        |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63a)       |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63b)       |
| 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    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 272.6679 | 241.1139 | 255.9282 | 224.3004 | 216.9839 | 195.0205 | 192.0241 | 199.8708 | 202.3263 | 226.2279 | 241.3351 | 269.5800  | (64)        |
| Total per year (kWh/year)                                                      |          |          |          |          |          |          |          |          |          |          |          | 2737.3789 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       | 86.4580  | 76.3731  | 80.8920  | 70.5114  | 67.9430  | 60.7758  | 59.6439  | 62.2529  | 63.2050  | 71.0167  | 76.1754  | 85.4313   | (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                                                                               | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1110  | 135.1943  | 122.1110  | 126.1814  | 122.1110  | 126.1814  | 122.1110  | 122.1110  | 126.1814  | 122.1110  | 126.1814  | 122.1110  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 242.0988  | 244.6110  | 238.2802  | 224.8029  | 207.7901  | 191.8005  | 181.1185  | 178.6062  | 184.9370  | 198.4143  | 215.4271  | 231.4167  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | (71) |
| Water heating gains (Table 5)                                                       | 116.2070  | 113.6504  | 108.7258  | 97.9325   | 91.3213   | 84.4109   | 80.1666   | 83.6733   | 87.7847   | 95.4525   | 105.7992  | 114.8270  | (72) |
| Total internal gains                                                                | 546.1332  | 559.1723  | 534.8336  | 514.6332  | 486.9389  | 465.1092  | 446.1125  | 447.1070  | 461.6195  | 481.6944  | 513.1242  | 534.0712  | (73) |

|                        |          |          |          |           |           |           |           |           |          |          |          |               |
|------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|---------------|
| Solar gains            | 118.1877 | 222.7583 | 361.7391 | 543.6715  | 696.0881  | 729.3802  | 687.2509  | 567.6819  | 423.8178 | 261.5510 | 145.4662 | 98.6174 (83)  |
| AB Conservation Budget |          | 9306     | 896.5727 | 1058.3047 | 1183.0270 | 1194.4895 | 1133.3634 | 1014.7889 | 885.4373 | 743.2454 | 658.5904 | 632.6886 (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, n11,m (see Table 9a)          |              |

|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| tau                    | 32.8582 | 33.2033 | 33.5557 | 35.4274 | 35.8118 | 37.7169 | 37.7169 | 38.0922 | 36.9596                   | 35.8118 | 35.0426 | 34.2833      |
| alpha                  | 3.1905  | 3.2136  | 3.2370  | 3.3618  | 3.3875  | 3.5145  | 3.5145  | 3.5395  | 3.4640                    | 3.3875  | 3.3362  | 3.2856       |
| util living area       | 0.9912  | 0.9844  | 0.9697  | 0.9232  | 0.8245  | 0.6550  | 0.5112  | 0.5758  | 0.8147                    | 0.9534  | 0.9853  | 0.9925 (86)  |
| MIT                    | 19.0836 | 19.2901 | 19.6281 | 20.1495 | 20.5457 | 20.8077 | 20.8795 | 20.8642 | 20.6662                   | 20.1484 | 19.5820 | 19.1210 (87) |
| Th 2                   | 19.5064 | 19.5193 | 19.5323 | 19.5976 | 19.6103 | 19.6702 | 19.6702 | 19.6814 | 19.6470                   | 19.6103 | 19.5846 | 19.5583 (88) |
| util rest of house     | 0.9884  | 0.9796  | 0.9599  | 0.8975  | 0.7655  | 0.5502  | 0.3704  | 0.4323  | 0.7300                    | 0.9327  | 0.9800  | 0.9903 (89)  |
| MIT 2                  | 17.3222 | 17.5935 | 18.0300 | 18.7212 | 19.1874 | 19.4966 | 19.5470 | 19.5517 | 19.3601                   | 18.7423 | 18.0123 | 17.4054 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.3502 (91)  |
| MIT                    | 17.9390 | 18.1876 | 18.5896 | 19.2214 | 19.6630 | 19.9557 | 20.0137 | 20.0114 | 19.8175                   | 19.2348 | 18.5620 | 18.0062 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | -0.1500      |
| adjusted MIT           | 17.7890 | 18.0376 | 18.4396 | 19.0714 | 19.5130 | 19.8057 | 19.8637 | 19.8614 | 19.6675                   | 19.0848 | 18.4120 | 17.8562 (93) |

### 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct       | Nov           | Dec             |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|---------------|-----------------|
| Utilisation                                                                    | 0.9838    | 0.9728    | 0.9498    | 0.8854    | 0.7606    | 0.5619   | 0.3921   | 0.4535   | 0.7315   | 0.9220    | 0.9737        | 0.9863 (94)     |
| Useful gains                                                                   | 653.5771  | 760.6422  | 851.5708  | 936.9733  | 899.8244  | 671.2322 | 444.3747 | 460.2026 | 647.7241 | 685.2922  | 641.2455      | 624.0253 (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                                                               | 2161.6465 | 2083.4547 | 1873.5841 | 1511.7772 | 1148.7934 | 726.7646 | 455.6366 | 478.4729 | 793.1918 | 1247.5603 | 1699.7749     | 2097.4605 (97)  |
| Space heating kwh                                                              | 1122.0036 | 888.9300  | 760.3779  | 413.8588  | 185.2330  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 418.3274  | 762.1412      | 1096.2358 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |           |               | 5647.1077       |
| Solar heating kwh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000        | 0.0000 (98b)    |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |           |          |          |          |          |           |               | 0.0000          |
| Space heating kwh                                                              | 1122.0036 | 888.9300  | 760.3779  | 413.8588  | 185.2330  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 418.3274  | 762.1412      | 1096.2358 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |           |               | 5647.1077       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          |           | (98c) / (4) = | 61.6093 (99)    |

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 %)                      | 92.3000 | (206) |
| Efficiency of main space heating system 2 (in %)                      | 0.0000  | (207) |
| Efficiency of secondary/supplementary heating system, %               | 0.0000  | (208) |

[illegible][illegible]

|                                                                                                      |         |         |         |         |         |         |         |         |         |         |         |                 |
|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------------|
| Pumps and Fa                                                                                         | 58.2630 | 52.6247 | 58.2630 | 56.3836 | 58.2630 | 56.3836 | 58.2630 | 58.2630 | 56.3836 | 58.2630 | 56.3836 | 58.2630 (231)   |
| Lighting                                                                                             | 28.7872 | 23.0941 | 20.7937 | 15.2344 | 11.7675 | 9.6141  | 10.7347 | 13.9533 | 18.1240 | 23.7797 | 26.8591 | 29.5873 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |                 |
| (233a)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 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |                 |
| (234a)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 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |                 |
| (235a)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 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |                 |
| (235c)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 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |         |         |         |         |         |         |         |         |         |         |         |                 |
| (233b)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 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |         |         |         |         |         |         |         |         |         |         |         |                 |
| (234b)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 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |         |         |         |         |         |         |         |         |         |         |         |                 |
| (235b)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 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |         |         |         |         |         |         |         |         |         |         |         |                 |
| (235d)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 (235d)   |
| Annual totals kWh/year                                                                               |         |         |         |         |         |         |         |         |         |         |         |                 |
| Space heating fuel - main system 1                                                                   |         |         |         |         |         |         |         |         |         |         |         | 6118.2098 (211) |
| Space heating fuel - main system 2                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (215)    |
| Efficiency of water heater                                                                           |         |         |         |         |         |         |         |         |         |         |         | 80.0000         |
| Water heating fuel used                                                                              |         |         |         |         |         |         |         |         |         |         |         | 2486.7936 (219) |
| Space cooling fuel                                                                                   |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |         |         |         |         |         |         |         |         |         |         |         |                 |
| central heating pump                                                                                 |         |         |         |         |         |         |         |         |         |         |         | 41.0000 (230c)  |
| main heating flue fan                                                                                |         |         |         |         |         |         |         |         |         |         |         | 45.0000 (230e)  |
| maintaining electric keep-hot facility for gas combi boiler                                          |         |         |         |         |         |         |         |         |         |         |         | 600.0000 (230f) |
| Total electricity for the above, kWh/year                                                            |         |         |         |         |         |         |         |         |         |         |         | 686.0000 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |         |         |         |         |         |         |         |         |         |         |         | 232.3290 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |         |         |         |         |         |         |         |         |         |         |         |                 |
| PV generation                                                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (233)    |
| Wind generation                                                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (235)    |
| Appendix Q - special features                                                                        |         |         |         |         |         |         |         |         |         |         |         |                 |
| Energy saved or generated                                                                            |         |         |         |         |         |         |         |         |         |         |         | -0.0000 (236)   |
| Energy used                                                                                          |         |         |         |         |         |         |         |         |         |         |         | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |         |         |         |         |         |         |         |         |         |         |         | 9523.3323 (238) |

#### 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 6118.2098          | 0.2100                        | 1284.8241 (261)          |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2486.7936          | 0.2100                        | 522.2266 (264)           |
| Space and water heating                         |                    |                               | 1807.0507 (265)          |
| Pumps, fans and electric keep-hot               | 686.0000           | 0.1387                        | 95.1567 (267)            |
| Energy for lighting                             | 232.3290           | 0.1443                        | 33.5322 (268)            |
| Total CO2, kg/year                              |                    |                               | 1935.7396 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 21.1200 (273)            |

#### 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 6118.2098          | 1.1300                              | 6913.5771 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2486.7936          | 1.1300                              | 2810.0767 (278)            |
| Space and water heating                     |                    |                                     | 9723.6538 (279)            |
| Pumps, fans and electric keep-hot           | 686.0000           | 1.5128                              | 1037.7808 (281)            |
| Energy for lighting                         | 232.3290           | 1.5338                              | 356.3539 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 11117.7885 (286)           |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 121.2900 (287)             |

#### 1. Overall dwelling characteristics

|              | Area<br>(m2) | Storey height<br>(m) | Volume<br>(m3)    |
|--------------|--------------|----------------------|-------------------|
| Ground floor | 91.6600 (1b) | x 2.5000 (2b)        | = 229.1500 (1b) - |

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 91.6600 (4)  
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 229.1500 (5)

## 2. Ventilation rate

m3 per hour

Number of open chimneys 0 \* 80 = 0.0000 (6a)  
 Number of open flues 0 \* 20 = 0.0000 (6b)  
 Number of flues attached to other heater 0 \* 10 = 0.0000 (6c)  
 Number of blocked chimneys 0 \* 20 = 0.0000 (6d)  
 Number of intermittent extract fans 0 \* 35 = 0.0000 (6e)  
 Number of passive vents 0 \* 20 = 0.0000 (6f)  
 Number of flueless gas fires 3 \* 10 = 30.0000 (7a)  
 0 \* 10 = 0.0000 (7b)  
 0 \* 40 = 0.0000 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1309 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 5.0000 (17)  
 Infiltration rate 0.3809 (18)  
 Number of sides sheltered 0 (19)  
 Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3809 (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 | 0.4857 | 0.4761 | 0.4666 | 0.4190 | 0.4095 | 0.3619 | 0.3619 | 0.3523 | 0.3809 | 0.4095 | 0.4285 | 0.4476 (22b) |
| Effective ac    | 0.6179 | 0.6134 | 0.6089 | 0.5878 | 0.5838 | 0.5655 | 0.5655 | 0.5621 | 0.5725 | 0.5838 | 0.5918 | 0.6002 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|
| TER Opening Type (Uw = 1.20)                   |             |                | 22.9100       | 1.1450           | 26.2328              |                   | (27)          |
| EXISTING EW                                    | 26.8400     | 17.1400        | 9.7000        | 0.1800           | 1.7460               |                   | (29a)         |
| PROPOSED EW                                    | 35.6200     | 5.7700         | 29.8500       | 0.1800           | 5.3730               |                   | (29a)         |
| SW                                             | 13.5500     |                | 13.5500       | 0.1800           | 2.4390               |                   | (29a)         |
| PROPOSED FR                                    | 57.4400     |                | 57.4400       | 0.1100           | 6.3184               |                   | (30)          |
| Total net area of external elements Aum(A, m2) |             |                | 133.4500      |                  |                      |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 42.1092           | (33)          |
| Party Wall                                     |             |                | 41.1400       | 0.0000           | 0.0000               |                   | (32)          |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 210.5427 (35)

### List of Thermal Bridges

| K1 Element                                                 | Length  | Psi-value | Total                              |
|------------------------------------------------------------|---------|-----------|------------------------------------|
| E2 Other lintels (including other steel lintels)           | 40.0000 | 0.0500    | 2.0000 (36)                        |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           | 0.0000                             |
| Point Thermal bridges                                      |         |           | (36a) =                            |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = 44.1092 (37) |

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

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 46.7282 | 46.3819 | 46.0424 | 44.4480 | 44.1497 | 42.7610 | 42.7610 | 42.5038 | 43.2959 | 44.1497 | 44.7532 | 45.3841 (38) |
| Heat transfer coeff       | 90.8374 | 90.4911 | 90.1516 | 88.5572 | 88.2589 | 86.8702 | 86.8702 | 86.6131 | 87.4051 | 88.2589 | 88.8624 | 89.4933 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 88.5558      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 0.9910 | 0.9872 | 0.9835 | 0.9661 | 0.9629 | 0.9477 | 0.9477 | 0.9449 | 0.9536 | 0.9629 | 0.9695 | 0.9764 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9661      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

## 4. Water heating energy requirements (kWh/year)

|                                          | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                        |          |          |          |          |          |          |          |          |          |          |          | 2.6478 (42)   |
| Hot water usage for mixer showers        | 68.6141  | 67.5830  | 66.0804  | 63.2055  | 61.0839  | 58.7179  | 57.3731  | 58.8643  | 60.4989  | 63.0393  | 65.9759  | 68.3512 (42a) |
| Hot water usage for baths                | 29.6295  | 29.1895  | 28.5698  | 27.4273  | 26.5717  | 25.6231  | 25.1107  | 25.7260  | 26.3960  | 27.4111  | 28.5772  | 29.5294 (42b) |
| Hot water usage for other uses           | 41.7458  | 40.2278  | 38.7097  | 37.1917  | 35.6737  | 34.1556  | 34.1556  | 35.6737  | 37.1917  | 38.7097  | 40.2278  | 41.7458 (42c) |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          | 128.6819 (43) |
| Daily hot water use                      | 139.9894 | 137.0002 | 133.3599 | 127.8245 | 123.3293 | 118.4966 | 116.6394 | 120.2640 | 124.0866 | 129.1601 | 134.7808 | 139.6264 (44) |

|                                                                 |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------|----------------|--------------------------------------------------------------------|
| Energy conte                                                    | 221.7090 | 195.0865 | 204.9693 | 174.9853 | 166.0249 | 145.7054 | 141.0652 | 148.9119 | 153.0112 | 175.2690                    | 192.0200       | 218.6211 (45)                                                      |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total =                     | Sum(45)m =     | 2137.3789                                                          |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|                                                                 | 33.2564  | 29.2630  | 30.7454  | 26.2478  | 24.9037  | 21.8558  | 21.1598  | 22.3368  | 22.9517  | 26.2903                     | 28.8030        | 32.7932 (46)                                                       |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                      | 0.0000         | 0.0000 (56)                                                        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                      | 0.0000         | 0.0000 (57)                                                        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                      | 0.0000         | 0.0000 (59)                                                        |
| Combi loss                                                      | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589                     | 49.3151        | 50.9589 (61)                                                       |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|                                                                 | 272.6679 | 241.1139 | 255.9282 | 224.3004 | 216.9839 | 195.0205 | 192.0241 | 199.8708 | 202.3263 | 226.2279                    | 241.3351       | 269.5800 (62)                                                      |
| AF Calculation Example                                          |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|                                                                 | 7417     | -29.0495 | -24.0541 | -22.4176 | -19.1829 | -17.9809 | -19.1209 | -19.8473 | -23.3978 | -26.5069                    | -30.7866 (63a) |                                                                    |
|                                                                 | 3000     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000                     | -0.0000 (63b)  |                                                                    |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                      | 0.0000 (63c)   |                                                                    |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                      | 0.0000 (63d)   |                                                                    |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|                                                                 | 241.3004 | 213.3722 | 226.8787 | 200.2463 | 194.5663 | 175.8376 | 174.0433 | 180.7499 | 182.4789 | 202.8301                    | 214.8282       | 238.7934 (64)                                                      |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = | Sum(64)m =     | 2445.9252 (64)                                                     |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          |                             |                | 2446 (64)                                                          |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                      | 0.0000         | 0.0000 (64a)                                                       |
|                                                                 |          |          |          |          |          |          |          |          |          |                             |                | Total Energy used by instantaneous electric shower(s) (kWh/year) = |
|                                                                 |          |          |          |          |          |          |          |          |          |                             |                | 0.0000 (64a)                                                       |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |                             |                |                                                                    |
|                                                                 | 86.4580  | 76.3731  | 80.8920  | 70.5114  | 67.9430  | 60.7758  | 59.6439  | 62.2529  | 63.2050  | 71.0167                     | 76.1754        | 85.4313 (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                                                                               | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883  | 132.3883 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1110  | 135.1943  | 122.1110  | 126.1814  | 122.1110  | 126.1814  | 122.1110  | 122.1110  | 126.1814  | 122.1110  | 126.1814  | 122.1110 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 242.0988  | 244.6110  | 238.2802  | 224.8029  | 207.7901  | 191.8005  | 181.1185  | 178.6062  | 184.9370  | 198.4143  | 215.4271  | 231.4167 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388   | 36.2388 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 | -105.9107 (71) |
| Water heating gains (Table 5)                                                       | 116.2070  | 113.6504  | 108.7258  | 97.9325   | 91.3213   | 84.4109   | 80.1666   | 83.6733   | 87.7847   | 95.4525   | 105.7992  | 114.8270 (72)  |
| Total internal gains                                                                | 546.1332  | 559.1723  | 534.8336  | 514.6332  | 486.9389  | 465.1092  | 446.1125  | 447.1070  | 461.6195  | 481.6944  | 513.1242  | 534.0712 (73)  |

## 6. Solar gains

| [Jan]     | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-----------|------------|--------------------------------|------------------------------|------------------------------------|------------------------------|--------------|
| Northeast | 17.1400    | 11.2829                        | 0.6300                       | 0.7000                             | 0.7700                       | 59.1024 (75) |
| Southeast | 4.6500     | 36.7938                        | 0.6300                       | 0.7000                             | 0.7700                       | 52.2877 (77) |
| Northwest | 1.1200     | 11.2829                        | 0.6300                       | 0.7000                             | 0.7700                       | 3.8620 (81)  |

|             |          |          |          |           |           |           |           |           |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|---------------|
| Solar gains | 115.2521 | 217.2312 | 352.7771 | 530.2215  | 678.8819  | 711.3567  | 670.2662  | 553.6435  | 413.3243 | 255.0650 | 141.8541 | 96.1673 (83)  |
| Total gains | 661.3853 | 776.4034 | 887.6107 | 1044.8547 | 1165.8208 | 1176.4660 | 1116.3788 | 1000.7505 | 874.9439 | 736.7593 | 654.9783 | 630.2385 (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, n11,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 59.0137 | 59.2395 | 59.4626 | 60.5332 | 60.7378 | 61.7087 | 61.7087 | 61.8919 | 61.3311 | 60.7378 | 60.3253 | 59.9000      |
| alpha                                                                       | 4.9342  | 4.9493  | 4.9642  | 5.0355  | 5.0492  | 5.1139  | 5.1139  | 5.1261  | 5.0887  | 5.0492  | 5.0217  | 4.9933       |
| util living area                                                            | 0.9905  | 0.9788  | 0.9478  | 0.8447  | 0.6638  | 0.4671  | 0.3414  | 0.3960  | 0.6533  | 0.9116  | 0.9801  | 0.9924 (86)  |
| MIT                                                                         | 19.8090 | 20.0360 | 20.3551 | 20.7374 | 20.9348 | 20.9911 | 20.9985 | 20.9970 | 20.9561 | 20.6576 | 20.1764 | 19.7828 (87) |
| Th 2                                                                        | 20.0908 | 20.0940 | 20.0971 | 20.1116 | 20.1144 | 20.1271 | 20.1271 | 20.1295 | 20.1222 | 20.1144 | 20.1088 | 20.1031 (88) |
| util rest of house                                                          | 0.9881  | 0.9734  | 0.9350  | 0.8123  | 0.6116  | 0.4056  | 0.2742  | 0.3221  | 0.5827  | 0.8841  | 0.9742  | 0.9904 (89)  |
| MIT 2                                                                       | 18.7060 | 18.9951 | 19.3938 | 19.8547 | 20.0616 | 20.1219 | 20.1266 | 20.1283 | 20.0926 | 19.7784 | 19.1861 | 18.6817 (90) |
| Living area fraction                                                        | 19.0923 | 19.3596 | 19.7305 | 20.1638 | 20.3674 | 20.4263 | 20.4319 | 20.4325 | 20.3950 | 20.0863 | 19.5329 | 19.0673 (91) |
| MIT                                                                         | 19.0923 | 19.3596 | 19.7305 | 20.1638 | 20.3674 | 20.4263 | 20.4319 | 20.4325 | 20.3950 | 20.0863 | 19.5329 | 19.0673 (92) |
| Temperature adjustment                                                      | 19.0923 | 19.3596 | 19.7305 | 20.1638 | 20.3674 | 20.4263 | 20.4319 | 20.4325 | 20.3950 | 20.0863 | 19.5329 | 19.0673 (93) |
| adjusted MIT                                                                | 19.0923 | 19.3596 | 19.7305 | 20.1638 | 20.3674 | 20.4263 | 20.4319 | 20.4325 | 20.3950 | 20.0863 | 19.5329 | 19.0673 (93) |

## 8. Space heating requirement

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

0.0000 (201)

1.00000 (202)

92.4000 (206)

0.00000 (207)

0.0000 (208)

Water heating

Space cooling fuel requirement

Electricity generated by PVs (

Electricity generated by wind

Electricity generated by hydro (225%)

|                                |        |        |   |
|--------------------------------|--------|--------|---|
| Electricity used or net electr | (225-) | 0.0000 | 0 |
|--------------------------------|--------|--------|---|

Electricity generated by PVs (

(233b)m -9.3025 -19.  
Electricity generated by wind

Electricity generated by wind  
(234b)m 0.0000 0

|                                |        |    |
|--------------------------------|--------|----|
| (234b)m                        | 0.0000 | 0. |
| Electricity generated by hydro |        |    |

|                                |        |   |
|--------------------------------|--------|---|
| Electricity generated by hydro | 0.0000 | 0 |
| (235b)m                        |        |   |

|                                | (2350)M | 0.0000 | 0. |
|--------------------------------|---------|--------|----|
| Electricity used or net electr |         |        |    |

|                                  |        |    |
|----------------------------------|--------|----|
| Electricity used or net electric |        |    |
| (235d)m                          | 0.0000 | 0. |

Annual totals kWh/year

Space heating fuel - main syst

Space heating fuel - main syst

Space heating fuel - secondary

Efficiency of water heater  
Water heating fuel used

Water heating fuel used  
Space cooling fuel

Space cooling fuelElectricity for pumps and fans

Total electricity for the above

Electricity for lighting (calc

Energy saving/generation techn

PV generation  
Wind generation

Wind generation  
Hydro-electric generation (App

Electricity generated - Micro

## Appendix 0 - special features

Energy saved or generatedEnergy used

Total delivered energy for all

-----

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2487.8337          | 0.2100                        | 522.4451 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2938.2805          | 0.2100                        | 617.0389 (264)           |
| Space and water heating                       |                    |                               | 1139.4840 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 204.7687           | 0.1443                        | 29.5544 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -584.5064          | 0.1337                        | -78.1241                 |
|                                               | -548.1249          | 0.1254                        | -68.7241                 |
|                                               |                    |                               | -146.8483 (269)          |
| Total CO2, kg/year                            |                    |                               | 1034.1194 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.2800 (273)            |

13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2487.8337          | 1.1300                              | 2811.2521 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2938.2805          | 1.1300                              | 3320.2569 (278)            |
| Space and water heating                     |                    |                                     | 6131.5090 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 204.7687           | 1.5338                              | 314.0810 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -584.5064          | 1.4939                              | -873.2092                  |
| PV Unit electricity exported                | -548.1249          | 0.4602                              | -252.2511                  |
| Total                                       |                    |                                     | -1125.4603 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5450.2306 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 59.4600 (287)              |

|                                    |                 |               |                |             |           |
|------------------------------------|-----------------|---------------|----------------|-------------|-----------|
| Property Reference                 | Flat 9          |               | Issued on Date | 14/06/2023  |           |
| Assessment Reference               | Flat 9          | Prop Type Ref |                |             |           |
| Property                           |                 |               |                |             |           |
| SAP Rating                         | 81 B            | DER           | 14.64          | TER         | 13.36     |
| Environmental                      | 87 B            | % DER < TER   | -9.58          |             |           |
| CO <sub>2</sub> Emissions (t/year) | 1.29            | DFEE          | 42.20          | TFEE        | 43.11     |
| Compliance Check                   | See BREL        | % DFEE < TFEE | 2.11           |             |           |
| % DPER < TPER                      | -21.25          | DPER          | 85.62          | TPER        | 70.61     |
| Assessor Details                   | Mr. George Farr |               |                | Assessor ID | T355-0001 |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 100.4500 (1b)             | x 2.4500 (2b)                   | = 246.1025 (1b) - (4)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 100.4500                  |                                 |                             |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 246.1025 (5)              |

2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract 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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1219 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3719 (18)                             |
| Number of sides sheltered                                                                          | 0 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 1.0000 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3719 (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 | 0.4742 | 0.4649 | 0.4556 | 0.4091 | 0.3998 | 0.3533 | 0.3533 | 0.3440 | 0.3719 | 0.3998 | 0.4184 | 0.4370 (22b) |
| Effective ac    | 0.6124 | 0.6081 | 0.6038 | 0.5837 | 0.5799 | 0.5624 | 0.5624 | 0.5592 | 0.5692 | 0.5799 | 0.5875 | 0.5955 (25)  |

3. Heat losses and heat loss parameter

| Element       | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|---------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| G (Uw = 1.10) |                         |                            | 22.7300                   | 1.0536                        | 23.9492      |                                | (27)            |
| RL            |                         |                            | 4.3700                    | 1.0536                        | 4.6044       |                                | (27a)           |
| PROPOSED EW   | 101.6300                | 19.0100                    | 82.6200                   | 0.1400                        | 11.5668      | 60.0000                        | 4957.2000 (29a) |
| SW            | 16.7600                 |                            | 16.7600                   | 0.2200                        | 3.6872       | 9.0000                         | 150.8400 (29a)  |
| SW            | 21.5700                 |                            | 21.5700                   | 0.2200                        | 4.7454       | 0.0000                         | 0.0000 (29a)    |
| DW            | 13.5700                 | 3.7200                     | 9.8500                    | 0.1400                        | 1.3790       | 9.0000                         | 88.6500 (29a)   |
| PROPOSED FR   | 90.2300                 | 4.3700                     | 85.8600                   | 0.1100                        | 9.4446       | 9.0000                         | 772.7400 (30)   |
| PR            | 12.1300                 |                            | 12.1300                   | 0.1100                        | 1.3343       | 9.0000                         | 109.1700 (30)   |

|                                                |                      |         |        |         |                  |
|------------------------------------------------|----------------------|---------|--------|---------|------------------|
| Total net area of external elements Aum(A, m2) | 255.8900             |         |        |         | (31)             |
| Fabric heat loss, W/K = Sum (A x U)            | (26)...(30) + (32) = | 60.7109 |        |         | (33)             |
| Party Wall                                     | 41.1400              | 0.0000  | 0.0000 | 45.0000 | 1851.3000 (32)   |
| PF                                             | 100.4500             |         |        | 40.0000 | 4018.0000 (32d)  |
| Internal Wall 1                                | 141.6600             |         |        | 75.0000 | 10624.5000 (32c) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22572.4000 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 224.7128 (35)

|                                                                  |         |           |         |  |  |
|------------------------------------------------------------------|---------|-----------|---------|--|--|
| List of Thermal Bridges                                          |         |           |         |  |  |
| K1 Element                                                       | Length  | Psi-value | Total   |  |  |
| E2 Other lintels (including other steel lintels)                 | 11.4000 | 0.0540    | 0.6156  |  |  |
| E3 Sill                                                          | 11.4000 | 0.0400    | 0.4560  |  |  |
| E4 Jamb                                                          | 26.6000 | 0.0490    | 1.3034  |  |  |
| E11 Flat roof                                                    | 63.9900 | 0.1300    | 8.3187  |  |  |
| E12 Flat roof                                                    | 9.8500  | -0.0310   | -0.3054 |  |  |
| E16 Corner (normal)                                              | 63.9900 | 0.0490    | 3.1355  |  |  |
| E17 Corner (inverted - internal area greater than external area) | 28.3000 | 0.0400    | 1.1320  |  |  |
| R1 Head of roof window                                           | 16.6000 | -0.0630   | -1.0458 |  |  |
| R2 Sill of roof window                                           | 1.9100  | 0.2400    | 0.4584  |  |  |
| R3 Jamb of roof window                                           | 1.9100  | 0.2400    | 0.4584  |  |  |
|                                                                  | 9.1600  | 0.2400    | 2.1984  |  |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.7253 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 77.4362 (37)

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (38)m                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| Heat transfer coeff                                                 | 49.7370  | 49.3824  | 49.0349  | 47.4027  | 47.0973  | 45.6757  | 45.6757  | 45.4124  | 46.2233  | 47.0973  | 47.7151  | 48.3610  | (38) |
| Average = Sum(39)m / 12 =                                           | 127.1732 | 126.8186 | 126.4711 | 124.8389 | 124.5335 | 123.1119 | 123.1119 | 122.8486 | 123.6595 | 124.5335 | 125.1513 | 125.7972 | (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 124.8374 |      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| HLP (average)                                                       | 1.2660   | 1.2625   | 1.2590   | 1.2428   | 1.2398   | 1.2256   | 1.2256   | 1.2230   | 1.2311   | 1.2398   | 1.2459   | 1.2523   | (40) |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |      |

4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.7437 (42) |
| Hot water usage for mixer showers                               | 70.2218  | 69.1665  | 67.6287  | 64.6865  | 62.5152  | 60.0938  | 58.7174  | 60.2436  | 61.9165  | 64.5164                                | 67.5218  | 69.9528   | (42a)       |
| Hot water usage for baths                                       | 30.3209  | 29.8706  | 29.2365  | 28.0673  | 27.1918  | 26.2210  | 25.6966  | 26.3263  | 27.0119  | 28.0507                                | 29.2440  | 30.2184   | (42b)       |
| Hot water usage for other uses                                  | 42.7277  | 41.1740  | 39.6203  | 38.0665  | 36.5128  | 34.9591  | 34.9591  | 36.5128  | 38.0665  | 39.6203                                | 41.1740  | 42.7277   | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 131.6978  | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec       |             |
| Energy conte                                                    | 143.2705 | 140.2111 | 136.4855 | 130.8203 | 126.2197 | 121.2738 | 119.3731 | 123.0826 | 126.9949 | 132.1873                               | 137.9398 | 142.8989  | (44)        |
| Energy content (annual)                                         | 226.9054 | 199.6588 | 209.7731 | 179.0864 | 169.9160 | 149.1203 | 144.3714 | 152.4020 | 156.5975 | 179.3769                               | 196.5205 | 223.7452  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 2187.4736 |             |
| Water storage loss:                                             | 34.0358  | 29.9488  | 31.4660  | 26.8630  | 25.4874  | 22.3680  | 21.6557  | 22.8603  | 23.4896  | 26.9065                                | 29.4781  | 33.5618   | (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                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                      | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589                                | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month | 277.8643 | 245.6862 | 260.7320 | 228.4015 | 220.8749 | 198.4353 | 195.3303 | 203.3609 | 205.9125 | 230.3359                               | 245.8356 | 274.7041  | (62)        |
| WWHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63a)       |
| PV diverter                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63b)       |
| 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    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                 | 277.8643 | 245.6862 | 260.7320 | 228.4015 | 220.8749 | 198.4353 | 195.3303 | 203.3609 | 205.9125 | 230.3359                               | 245.8356 | 274.7041  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2787.4736 | (64)        |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        | 88.1858  | 77.8934  | 82.4893  | 71.8750  | 69.2368  | 61.9113  | 60.7432  | 63.4134  | 64.3974  | 72.3826                                | 77.6718  | 87.1350   | (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      | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | 137.1826 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 129.6538 | 143.5453 | 129.6538 | 133.9756 | 129.6538 | 133.9756 | 129.6538 | 129.6538 | 133.9756 | 129.6538 | 133.9756 | 129.6538 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 257.0532 | 259.7206 | 252.9988 | 238.6890 | 220.6253 | 203.6480 | 192.3062 | 189.6387 | 196.3605 | 210.6704 | 228.7341 | 245.7113 | (69) |

[illegible]

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
|                                                                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)  |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                                            | 277.8643 | 245.6862 | 260.7320 | 228.4015 | 220.8749 | 198.4353 | 195.3303 | 203.3609 | 205.9125 | 230.3359 | 245.8356 | 274.7041  | (64)   |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 80.0000   | (216)  |
| (217)m                                                                                               | 88.7308  | 88.1757  | 87.1121  | 84.9342  | 82.0860  | 80.0000  | 80.0000  | 80.0000  | 80.0000  | 85.4959  | 87.9658  | 88.8371   | (217)  |
| Fuel for water heating, kWh/month                                                                    | 255.7235 | 226.4328 | 240.8081 | 210.8533 | 206.9976 | 186.4003 | 180.4642 | 190.5025 | 195.7468 | 209.8075 | 223.4055 | 251.8602  | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (221)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    | (221)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 5247     | 58.2630  | 56.3836  | 58.2630  | 56.3836  | 58.2630  | 58.2630  | 56.3836  | 58.2630  | 56.3836  | 58.2630  | 58.2630   | (231)  |
| (233a)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    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234a)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    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235a)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    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235c)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    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233b)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    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234b)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    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235b)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    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235d)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    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 3826.4683 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 80.0000   |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2579.0024 | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000   | (230c) |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| maintaining electric keep-hot facility for gas combi boiler                                          |          |          |          |          |          |          |          |          |          |          |          | 600.0000  | (230f) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 686.0000  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 211.2914  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 7302.7621 | (238)  |

#### 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 3826.4683          | 0.2100                        | 803.5583 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2579.0024          | 0.2100                        | 541.5905 (264)           |
| Space and water heating                         |                    |                               | 1345.1488 (265)          |
| Pumps, fans and electric keep-hot               | 686.0000           | 0.1387                        | 95.1567 (267)            |
| Energy for lighting                             | 211.2914           | 0.1443                        | 30.4959 (268)            |
| Total CO2, kg/year                              |                    |                               | 1470.8014 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 14.6400 (273)            |

#### 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3826.4683          | 1.1300                              | 4323.9091 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2579.0024          | 1.1300                              | 2914.2728 (278)            |
| Space and water heating                     |                    |                                     | 7238.1819 (279)            |
| Pumps, fans and electric keep-hot           | 686.0000           | 1.5128                              | 1037.7808 (281)            |
| Energy for lighting                         | 211.2914           | 1.5338                              | 324.0858 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 8600.0485 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 85.6200 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

| Ground floor                    | Area<br>(m <sup>2</sup> ) | Storey height<br>(m) | Volume<br>(m <sup>3</sup> ) |
|---------------------------------|---------------------------|----------------------|-----------------------------|
| 100.4500 (1b)                   | x                         | 2.4500 (2b)          | = 246.1025 (1b) - (4)       |
| (3a)+(3b)+(3c)+(3d)+(3e)...(3n) |                           |                      | = 246.1025 (5)              |

2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract 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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 40.0000 / (5) = 0.1625 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.4125 (18)                             |
| Number of sides sheltered                                                                          | 0 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 1.0000 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.4125 (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 | 0.5260 | 0.5157 | 0.5054 | 0.4538 | 0.4435 | 0.3919 | 0.3919 | 0.3816 | 0.4125 | 0.4435 | 0.4641 | 0.4847 (22b) |
| Effective ac    | 0.6383 | 0.6330 | 0.6277 | 0.6030 | 0.5983 | 0.5768 | 0.5768 | 0.5728 | 0.5851 | 0.5983 | 0.6077 | 0.6175 (25)  |

3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| TER Opening Type (Uw = 1.20)                                |                         |                            | 21.0600                   | 1.1450                        | 24.1145      |                                | (27)          |
| RL                                                          |                         |                            | 4.0500                    | 1.5918                        | 6.4466       |                                | (27a)         |
| PROPOSED EW                                                 | 101.6300                | 17.6100                    | 84.0200                   | 0.1800                        | 15.1236      |                                | (29a)         |
| SW                                                          | 16.7600                 |                            | 16.7600                   | 0.1800                        | 3.0168       |                                | (29a)         |
| SW                                                          | 21.5700                 |                            | 21.5700                   | 0.1800                        | 3.8826       |                                | (29a)         |
| DW                                                          | 13.5700                 | 3.4500                     | 10.1200                   | 0.1800                        | 1.8216       |                                | (29a)         |
| PROPOSED FR                                                 | 90.2300                 | 4.0500                     | 86.1800                   | 0.1100                        | 9.4798       |                                | (30)          |
| PR                                                          | 12.1300                 |                            | 12.1300                   | 0.1100                        | 1.3343       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 255.8900                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 65.2198      |                                | (33)          |
| Party Wall                                                  |                         |                            | 41.1400                   | 0.0000                        | 0.0000       |                                | (32)          |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 224.7128 (35)

List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value             | Total        |
|------------------------------------------------------------------|---------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)                 | 11.4000 | 0.0500                | 0.5700       |
| E3 Sill                                                          | 11.4000 | 0.0500                | 0.5700       |
| E4 Jamb                                                          | 26.6000 | 0.0500                | 1.3300       |
| E7 Party floor between dwellings (in blocks of flats)            | 63.9900 | 0.0700                | 4.4793       |
| E11 Eaves (insulation at rafter level)                           | 9.8500  | 0.0400                | 0.3940       |
| E14 Flat roof                                                    | 63.9900 | 0.0800                | 5.1192       |
| E16 Corner (normal)                                              | 28.3000 | 0.0900                | 2.5470       |
| E17 Corner (inverted - internal area greater than external area) | 16.6000 | -0.0900               | -1.4940      |
| R1 Head of roof window                                           | 1.9100  | 0.0800                | 0.1528       |
| R2 Sill of roof window                                           | 1.9100  | 0.0600                | 0.1146       |
| R3 Jamb of roof window                                           | 9.1600  | 0.0800                | 0.7328       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |                       | 14.5157 (36) |
| Point Thermal bridges                                            |         | (36a) =               | 0.0000       |
| Total fabric heat loss                                           |         | (33) + (36) + (36a) = | 79.7355 (37) |

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

|       | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m | 51.8410 | 51.4048 | 50.9772 | 48.9688 | 48.5930 | 46.8438 | 46.8438 | 46.5198 | 47.5176 | 48.5930 | 49.3532 | 50.1479 (38) |

Heat transfer coeff

|                                                                                     |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|-------------------------------------------------------------------------------------|--------------------|-----------|------------|-----------|---------------|-----------|---------------|-----------|-----------|-----------|-----------|----------------|---------------------------|
| Average = Sum(39)m / 12 =                                                           |                    |           |            |           |               |           |               |           |           |           |           |                | 129.8835 (39)<br>128.7025 |
| HLP                                                                                 | Jan                | Feb       | Mar        | Apr       | May           | Jun       | Jul           | Aug       | Sep       | Oct       | Nov       | Dec            |                           |
| HLP (average)                                                                       | 1.3099             | 1.3055    | 1.3013     | 1.2813    | 1.2775        | 1.2601    | 1.2601        | 1.2569    | 1.2668    | 1.2775    | 1.2851    | 1.2930         | (40)                      |
| Days in mont                                                                        | 31                 | 28        | 31         | 30        | 31            | 30        | 31            | 31        | 30        | 31        | 30        | 31             |                           |
| -----                                                                               |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
| 4. Water heating energy requirements (kWh/year)                                     |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
| -----                                                                               |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
| Hot water usage for mixer showers                                                   |                    |           |            |           |               |           |               |           |           |           |           |                | 2.7437 (42)               |
|                                                                                     | 70.2218            | 69.1665   | 67.6287    | 64.6865   | 62.5152       | 60.0938   | 58.7174       | 60.2436   | 61.9165   | 64.5164   | 67.5218   | 69.9528        | (42a)                     |
| Hot water usage for baths                                                           |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 30.3209            | 29.8706   | 29.2365    | 28.0673   | 27.1918       | 26.2210   | 25.6966       | 26.3263   | 27.0119   | 28.0507   | 29.2440   | 30.2184        | (42b)                     |
| Hot water usage for other uses                                                      |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 42.7277            | 41.1740   | 39.6203    | 38.0665   | 36.5128       | 34.9591   | 34.9591       | 36.5128   | 38.0665   | 39.6203   | 41.1740   | 42.7277        | (42c)                     |
| Average daily hot water use (litres/day)                                            |                    |           |            |           |               |           |               |           |           |           |           |                | 131.6978 (43)             |
| -----                                                                               |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
| Daily hot water use                                                                 | Jan                | Feb       | Mar        | Apr       | May           | Jun       | Jul           | Aug       | Sep       | Oct       | Nov       | Dec            |                           |
|                                                                                     | 143.2705           | 140.2111  | 136.4855   | 130.8203  | 126.2197      | 121.2738  | 119.3731      | 123.0826  | 126.9949  | 132.1873  | 137.9398  | 142.8989       | (44)                      |
| Energy conte                                                                        | 226.9054           | 199.6588  | 209.7731   | 179.0864  | 169.9160      | 149.1203  | 144.3714      | 152.4020  | 156.5975  | 179.3769  | 196.5205  | 223.7452       | (45)                      |
| Energy content (annual)                                                             | Total = Sum(45)m = |           |            |           |               |           |               |           |           |           |           | 2187.4736      |                           |
| Distribution loss (46)m = 0.15 x (45)m                                              | 34.0358            | 29.9488   | 31.4660    | 26.8630   | 25.4874       | 22.3680   | 21.6557       | 22.8603   | 23.4896   | 26.9065   | 29.4781   | 33.5618        | (46)                      |
| Water storage loss:                                                                 |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
| Total storage loss                                                                  |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 0.0000             | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000    | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000         | (56)                      |
| If cylinder contains dedicated solar storage                                        |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 0.0000             | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000    | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000         | (57)                      |
| Primary loss                                                                        | 0.0000             | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000    | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000         | (59)                      |
| Combi loss                                                                          | 50.9589            | 46.0274   | 50.9589    | 49.3151   | 50.9589       | 49.3151   | 50.9589       | 50.9589   | 49.3151   | 50.9589   | 49.3151   | 50.9589        | (61)                      |
| Total heat required for water heating calculated for each month                     |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 277.8643           | 245.6862  | 260.7320   | 228.4015  | 220.8749      | 198.4353  | 195.3303      | 203.3609  | 205.9125  | 230.3359  | 245.8356  | 274.7041       | (62)                      |
| WWHRS                                                                               | -32.1025           | -28.3917  | -29.7302   | -24.6177  | -22.9429      | -19.6324  | -18.4022      | -19.5689  | -20.3124  | -23.9461  | -27.1280  | -31.5080       | (63a)                     |
| PV diverter                                                                         | -0.0000            | -0.0000   | -0.0000    | -0.0000   | -0.0000       | -0.0000   | -0.0000       | -0.0000   | -0.0000   | -0.0000   | -0.0000   | -0.0000        | (63b)                     |
| 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         | (63c)                     |
| FGHRS                                                                               | 0.0000             | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000    | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000         | (63d)                     |
| Output from w/h                                                                     | 245.7618           | 217.2945  | 231.0019   | 203.7838  | 197.9321      | 178.8030  | 176.9281      | 183.7920  | 185.6001  | 206.3898  | 218.7076  | 243.1961       | (64)                      |
| Total per year (kWh/year) = Sum(64)m =                                              |                    |           |            |           |               |           |               |           |           |           |           | 2489.1908 (64) |                           |
| 12Total per year (kWh/year)                                                         |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
| Electric shower(s)                                                                  |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 0.0000             | 0.0000    | 0.0000     | 0.0000    | 0.0000        | 0.0000    | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000         | (64a)                     |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =      |                    |           |            |           |               |           |               |           |           |           |           | 0.0000 (64a)   |                           |
| Heat gains from water heating, kWh/month                                            |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 88.1858            | 77.8934   | 82.4893    | 71.8750   | 69.2368       | 61.9113   | 60.7432       | 63.4134   | 64.3974   | 72.3826   | 77.6718   | 87.1350        | (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            |                           |
|                                                                                     | 137.1826           | 137.1826  | 137.1826   | 137.1826  | 137.1826      | 137.1826  | 137.1826      | 137.1826  | 137.1826  | 137.1826  | 137.1826  | 137.1826       | (66)                      |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 129.6538           | 143.5453  | 129.6538   | 133.9756  | 129.6538      | 133.9756  | 129.6538      | 129.6538  | 133.9756  | 129.6538  | 133.9756  | 129.6538       | (67)                      |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 257.0532           | 259.7206  | 252.9988   | 238.6890  | 220.6253      | 203.6480  | 192.3062      | 189.6387  | 196.3605  | 210.6704  | 228.7341  | 245.7113       | (68)                      |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 36.7183            | 36.7183   | 36.7183    | 36.7183   | 36.7183       | 36.7183   | 36.7183       | 36.7183   | 36.7183   | 36.7183   | 36.7183   | 36.7183        | (69)                      |
| Pumps, fans                                                                         | 3.0000             | 3.0000    | 3.0000     | 3.0000    | 3.0000        | 0.0000    | 0.0000        | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000         | (70)                      |
| Losses e.g. evaporation (negative values) (Table 5)                                 |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | -109.7461          | -109.7461 | -109.7461  | -109.7461 | -109.7461     | -109.7461 | -109.7461     | -109.7461 | -109.7461 | -109.7461 | -109.7461 | -109.7461      | (71)                      |
| Water heating gains (Table 5)                                                       |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 118.5293           | 115.9128  | 110.8727   | 99.8264   | 93.0602       | 85.9879   | 81.6441       | 85.2331   | 89.4409   | 97.2884   | 107.8776  | 117.1169       | (72)                      |
| Total internal gains                                                                |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
|                                                                                     | 572.3911           | 586.3335  | 560.6802   | 539.6458  | 510.4941      | 487.7663  | 467.7589      | 468.6804  | 483.9318  | 504.7674  | 537.7420  | 559.6369       | (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  |           |           |                |                           |
| Northeast                                                                           | 2.9800             |           | 11.2829    |           | 0.6300        |           | 0.7000        |           | 0.7700    |           | 10.2757   |                | (75)                      |
| Southeast                                                                           | 14.6300            |           | 36.7938    |           | 0.6300        |           | 0.7000        |           | 0.7700    |           | 164.5096  |                | (77)                      |
| Northwest                                                                           | 3.4500             |           | 11.2829    |           | 0.6300        |           | 0.7000        |           | 0.7700    |           | 11.8963   |                | (81)                      |
| North                                                                               | 4.0500             |           | 26.0000    |           | 0.6300        |           | 0.7000        |           | 1.0000    |           | 41.7936   |                | (82)                      |
| -----                                                                               |                    |           |            |           |               |           |               |           |           |           |           |                |                           |
| Solar gains                                                                         | 228.4752           | 412.1545  | 619.0380   | 849.7200  | 1020.2437     | 1041.1215 | 992.1313      | 861.8296  | 699.0896  | 470.9495  | 277.9884  | 192.6490       | (83)                      |
| Total gains                                                                         | 800.8663           | 998.4880  | 1179.7181  | 1389.3657 | 1530.7378     | 1528.8878 | 1459.8901     | 1330.5100 | 1183.0214 | 975.7169  | 815.7304  | 752.2859       | (84)                      |

## 21.0000 (85)

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|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9831    | 0.9622    | 0.9186    | 0.8138    | 0.6488    | 0.4553   | 0.3132   | 0.3603   | 0.6115   | 0.8761        | 0.9669    | 0.9865 (94)    |
| Useful gains                                                                   | 787.3076  | 960.7352  | 1083.6920 | 1130.6896 | 993.1152  | 696.1327 | 457.2145 | 479.4387 | 723.3893 | 854.7927      | 788.7300  | 742.1306 (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                                                               | 1864.6712 | 1826.3559 | 1671.9192 | 1404.5486 | 1078.3520 | 710.4432 | 459.3957 | 483.3706 | 771.3354 | 1172.5644     | 1538.7048 | 1848.2385 (97) |
| Space heating kWh                                                              | 801.5585  | 581.6971  | 437.6410  | 197.1785  | 63.4162   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 236.4222      | 539.9818  | 822.9442 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |               |           | 3680.8396      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |           |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 801.5585  | 581.6971  | 437.6410  | 197.1785  | 63.4162   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 236.4222      | 539.9818  | 822.9442 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |               |           | 3680.8396      |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          |               |           | 36.6435 (99)   |
|                                                                                |           |           |           |           |           |          |          |          |          | (98c) / (4) = |           |                |

|                                                                       |         |       |
|-----------------------------------------------------------------------|---------|-------|
| 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 %)                      | 92.4000 | (206) |
| Efficiency of main space heating system 2 (in %)                      | 0.0000  | (207) |
| Efficiency of secondary/supplementary heating system, %               | 0.0000  | (208) |

[illegible]

|                                                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
|------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------|--------|
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |        |        |        |        |        |        |        |        |        |        |        |            |        |
| (235d)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     | (235d) |
| Annual totals kWh/year                                                                               |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Space heating fuel - main system 1                                                                   |        |        |        |        |        |        |        |        |        |        |        | 3983.5927  | (211)  |
| Space heating fuel - main system 2                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |        |        |        |        |        |        |        |        |        |        |        | 80.3000    |        |
| Water heating fuel used                                                                              |        |        |        |        |        |        |        |        |        |        |        | 2967.4302  | (219)  |
| Space cooling fuel                                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Total electricity for the above, kWh/year                                                            |        |        |        |        |        |        |        |        |        |        |        | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |        |        |        |        |        |        |        |        |        |        |        | 217.4172   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |        |        |        |        |        |        |        |        |        |        |        |            |        |
| PV generation                                                                                        |        |        |        |        |        |        |        |        |        |        |        | -1241.2482 | (233)  |
| Wind generation                                                                                      |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |        |        |        |        |        |        |        |        |        |        |        |            |        |
| Energy saved or generated                                                                            |        |        |        |        |        |        |        |        |        |        |        | -0.0000    | (236)  |
| Energy used                                                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |        |        |        |        |        |        |        |        |        |        |        | 6013.1918  | (238)  |

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
-----

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 3983.5927          | 0.2100                        | 836.5545 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2967.4302          | 0.2100                        | 623.1603 (264)           |
| Space and water heating                       |                    |                               | 1459.7148 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 217.4172           | 0.1443                        | 31.3800 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -632.7901          | 0.1337                        | -84.6080                 |
| PV Unit electricity exported                  | -608.4582          | 0.1254                        | -76.3013                 |
| Total                                         |                    |                               | -160.9093 (269)          |
| Total CO2, kg/year                            |                    |                               | 1342.1148 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 13.3600 (273)            |

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13a. Primary energy - Individual heating systems including micro-CHP  
-----

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3983.5927          | 1.1300                              | 4501.4597 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2967.4302          | 1.1300                              | 3353.1961 (278)            |
| Space and water heating                     |                    |                                     | 7854.6558 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 217.4172           | 1.5338                              | 333.4818 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -632.7901          | 1.4941                              | -945.4553                  |
| PV Unit electricity exported                | -608.4582          | 0.4603                              | -280.0636                  |
| Total                                       |                    |                                     | -1225.5189 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 7092.7195 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 70.6100 (287)              |