

# Full SAP Calculation Printout



|                                    |             |                 |               |               |                 |             |           |
|------------------------------------|-------------|-----------------|---------------|---------------|-----------------|-------------|-----------|
| Property Reference                 | Flat 3_Copy |                 |               |               | Issued on Date  | 22/11/2023  |           |
| Assessment Reference               | 001_Copy    |                 |               | Prop Type Ref | 118 Malden Road |             |           |
| Property                           |             |                 |               |               |                 |             |           |
|                                    |             |                 |               |               |                 |             |           |
| SAP Rating                         |             | 82 B            | DER           | 10.07         | TER             | 11.61       |           |
| Environmental                      |             | 92 A            | % DER < TER   |               |                 |             | 13.26     |
| CO <sub>2</sub> Emissions (t/year) |             | 0.57            | DFEE          | 25.06         | TFEE            | 25.69       |           |
| Compliance Check                   |             | See BREL        | % DFEE < TFEE |               |                 |             | 2.45      |
| % DPER < TPER                      |             | -8.58           | DPER          | 66.24         | TPER            | 61.01       |           |
|                                    |             |                 |               |               |                 |             |           |
| Assessor Details                   |             | Mr. Daniel Watt |               |               |                 | Assessor ID | AV75-0001 |
| Client                             |             |                 |               |               |                 |             |           |

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                                           | 61.8300 (1b)              | 2.5000 (2b)                     | 154.5750 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.8300                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 154.5750 (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                | 0 * 10 = 0.0000 (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) = | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test                                                                                      | Yes            |            |
| Pressure Test Method                                                                               | Blower Door    |            |
| Measured/design AP50                                                                               | 3.0000         | (17)       |
| Infiltration rate                                                                                  | 0.1500         | (18)       |
| Number of sides sheltered                                                                          | 2              | (19)       |

|                                                      |                             |             |
|------------------------------------------------------|-----------------------------|-------------|
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =        | 0.1275 (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                                                                                         | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b)  |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |        |               |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a)  |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 80.1000 (23c) |
| Effective ac                                                                                            | 0.2621 | 0.2589 | 0.2557 | 0.2397 | 0.2366 | 0.2206 | 0.2206 | 0.2174 | 0.2270 | 0.2366 | 0.2429 | 0.2493 (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   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------------------------------|--------------------------------|-----------------|
| Front (Uw = 1.20)                                              |                         |                            | 18.8000                   | 1.1450                        | 21.5267                              |                                | (27)            |
| External Walls                                                 | 55.7500                 | 18.8000                    | 36.9500                   | 0.1800                        | 6.6510                               | 70.0000                        | 2586.5000 (29a) |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 55.7500                   |                               |                                      |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) =                 | 28.1777                        | (33)            |
| Party Floor 1                                                  |                         |                            | 61.8300                   |                               |                                      | 40.0000                        | 2473.2000 (32d) |
| Party Ceiling 1                                                |                         |                            | 61.8300                   |                               |                                      | 30.0000                        | 1854.9000 (32b) |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               | (28)...(30) + (32) + (32a)...(32e) = |                                | 6914.6000 (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                                      |                                | 111.8324 (35)   |
| List of Thermal Bridges                                        |                         |                            |                           |                               |                                      |                                |                 |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value                            | Total                          |                 |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 8.9500                        | 0.0300                               | 0.2685                         |                 |
| E3 Sill                                                        |                         |                            |                           | 3.9500                        | 0.0400                               | 0.1580                         |                 |
| E4 Jamb                                                        |                         |                            |                           | 15.6000                       | 0.0500                               | 0.7800                         |                 |
| E18 Party wall between dwellings                               |                         |                            |                           | 5.0000                        | 0.0600                               | 0.3000                         |                 |

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|                                                            |         |                       |         |              |
|------------------------------------------------------------|---------|-----------------------|---------|--------------|
| E7 Party floor between dwellings (in blocks of flats)      | 41.0000 | 0.0700                | 2.8700  |              |
| E16 Corner (normal)                                        | 5.0000  | 0.0900                | 0.4500  |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       |         | 4.8265 (36)  |
| Point Thermal bridges                                      |         |                       | (36a) = | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = |         | 33.0042 (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                                                 | 13.3677 | 13.2051 | 13.0426 | 12.2296 | 12.0670 | 11.2540 | 11.2540 | 11.0914 | 11.5792 | 12.0670 | 12.3922 | 12.7174 (38) |
| Average = Sum(39)m / 12 =                                           | 46.3720 | 46.2094 | 46.0468 | 45.2338 | 45.0712 | 44.2582 | 44.2582 | 44.0957 | 44.5834 | 45.0712 | 45.3964 | 45.7216 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 45.1932      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 0.7500  | 0.7474  | 0.7447  | 0.7316  | 0.7290  | 0.7158  | 0.7158  | 0.7132  | 0.7211  | 0.7290  | 0.7342  | 0.7395 (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                                               |          |          |          |          |          |          |          |          |          |                                        |          | 2.0329 (42)    |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |                                        |          |                |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | (42a)          |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |                                        |          |                |
| 67.1953                                                         | 66.1973  | 64.7920  | 62.2009  | 60.2606  | 58.1092  | 56.9472  | 58.3427  | 59.8621  | 62.1641  | 64.8087                                | 66.9681  | (42b)          |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |                                        |          |                |
| 35.4487                                                         | 34.1596  | 32.8706  | 31.5815  | 30.2925  | 29.0035  | 29.0035  | 30.2925  | 31.5815  | 32.8706  | 34.1596                                | 35.4487  | (42c)          |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 94.5267 (43)   |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec            |
| Daily hot water use                                             | 102.6439 | 100.3569 | 97.6626  | 93.7824  | 90.5531  | 87.1127  | 85.9506  | 88.6352  | 91.4436  | 95.0347                                | 98.9683  | 102.4168 (44)  |
| Energy conte                                                    | 162.5629 | 142.9070 | 150.1038 | 128.3834 | 121.9019 | 107.1152 | 103.9498 | 109.7488 | 112.7591 | 128.9612                               | 140.9985 | 160.3599 (45)  |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 1569.7516      |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |                                        |          |                |
| 24.3844                                                         | 21.4360  | 22.5156  | 19.2575  | 18.2853  | 16.0673  | 15.5925  | 16.4623  | 16.9139  | 19.3442  | 21.1498                                | 24.0540  | (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   | (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   | (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   | (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  | (61)           |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                                        |          |                |
| 213.5218                                                        | 188.9344 | 201.0627 | 177.6985 | 172.8608 | 156.4303 | 154.9087 | 160.7077 | 162.0742 | 179.9201 | 190.3135                               | 211.3188 | (62)           |
| WWHRS                                                           | 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   | (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                                                 | 213.5218 | 188.9344 | 201.0627 | 177.6985 | 172.8608 | 156.4303 | 154.9087 | 160.7077 | 162.0742 | 179.9201                               | 190.3135 | (64)           |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2169.7516 (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   | (64a)          |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 66.7919  | 59.0234  | 62.6492  | 55.0163  | 53.2721  | 47.9446  | 47.3030  | 49.2312  | 49.8212  | 55.6193                                | 59.2108  | 66.0594 (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           |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 89.5473  | 99.1416  | 89.5473  | 92.5322  | 89.5473  | 92.5322  | 89.5473  | 89.5473  | 92.5322  | 89.5473  | 92.5322  | 89.5473 (67)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 177.5375 | 179.3798 | 174.7373 | 164.8540 | 152.3781 | 140.6524 | 132.8190 | 130.9767 | 135.6192 | 145.5026 | 157.9785 | 169.7041 (68) |
| Pumps, fans                                                                         | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644 (69)  |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 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)   |
| Water heating gains (Table 5)                                                       | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 (71) |
| Total internal gains                                                                | 89.7740  | 87.8325  | 84.2060  | 76.4115  | 71.6023  | 66.5897  | 63.5794  | 66.1710  | 69.1961  | 74.7572  | 82.2372  | 88.7895 (72)  |
|                                                                                     | 413.3520 | 422.8470 | 404.9837 | 390.2908 | 370.0208 | 353.2675 | 339.4388 | 340.1881 | 350.8406 | 366.3001 | 389.2410 | 404.5340 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |            |                                |                                   |                                    |          |                              |          |               |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|------------------------------|----------|---------------|---------------|
|             |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W    |               |
| North       |          |          |          | 2.3000     | 10.6334                        | 0.7200                            | 0.7000                             |          | 0.7700                       |          | 8.5421 (74)   |               |
| East        |          |          |          | 5.0000     | 19.6403                        | 0.7200                            | 0.7000                             |          | 0.7700                       |          | 34.2990 (76)  |               |
| South       |          |          |          | 11.5000    | 46.7521                        | 0.7200                            | 0.7000                             |          | 0.7700                       |          | 187.7857 (78) |               |
|             |          |          |          |            |                                |                                   |                                    |          |                              |          |               |               |
| Solar gains | 230.6267 | 390.9649 | 529.9939 | 648.4809   | 718.9160                       | 710.4606                          | 686.3140                           | 634.2545 | 571.1013                     | 430.7628 | 275.8946      | 197.5910 (83) |
| Total gains | 643.9787 | 813.8119 | 934.9775 | 1038.7717  | 1088.9368                      | 1063.7281                         | 1025.7528                          | 974.4427 | 921.9419                     | 797.0629 | 665.1355      | 602.1250 (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)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|                                                                             | 41.4199 | 41.5656 | 41.7124 | 42.4621 | 42.6153 | 43.3981 | 43.3981 | 43.5581 | 43.0815 | 42.6153 | 42.3100 | 42.0091      |

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|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| alpha                  | 3.7613  | 3.7710  | 3.7808  | 3.8308  | 3.8410  | 3.8932  | 3.8932  | 3.9039  | 3.8721  | 3.8410  | 3.8207  | 3.8006       |
| util living area       | 0.8560  | 0.7536  | 0.6427  | 0.5045  | 0.3788  | 0.2651  | 0.1896  | 0.2078  | 0.3305  | 0.5539  | 0.7712  | 0.8757 (86)  |
| MIT                    | 20.3261 | 20.5712 | 20.7409 | 20.8572 | 20.9019 | 20.9175 | 20.9201 | 20.9200 | 20.9124 | 20.8469 | 20.6043 | 20.2776 (87) |
| Th 2                   | 20.2969 | 20.2992 | 20.3015 | 20.3130 | 20.3153 | 20.3269 | 20.3269 | 20.3292 | 20.3223 | 20.3153 | 20.3107 | 20.3061 (88) |
| util rest of house     | 0.8419  | 0.7344  | 0.6197  | 0.4792  | 0.3522  | 0.2376  | 0.1607  | 0.1776  | 0.2989  | 0.5231  | 0.7497  | 0.8631 (89)  |
| MIT 2                  | 19.5122 | 19.8061 | 20.0053 | 20.1464 | 20.1958 | 20.2227 | 20.2248 | 20.2272 | 20.2136 | 20.1405 | 19.8611 | 19.4614 (90) |
| Living area fraction   | 19.9400 | 20.2083 | 20.3920 | 20.5200 | 20.5670 | 20.5879 | 20.5903 | 20.5914 | 20.5809 | 20.5118 | 20.2517 | 19.8904 (92) |
| MIT                    | 19.9400 | 20.2083 | 20.3920 | 20.5200 | 20.5670 | 20.5879 | 20.5903 | 20.5914 | 20.5809 | 20.5118 | 20.2517 | 19.8904 (93) |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |

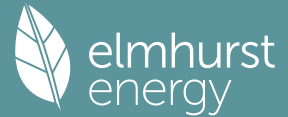
## 8. Space heating requirement

|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
| Utilisation                                                                    | 0.8342   | 0.7318   | 0.6227   | 0.4869   | 0.3620   | 0.2483   | 0.1720   | 0.1894   | 0.3110   | 0.5321        | 0.7478   | 0.8548 (94)    |
| Useful gains                                                                   | 537.1867 | 595.5522 | 582.2128 | 505.7794 | 394.2196 | 264.1235 | 176.4467 | 184.5931 | 286.7143 | 424.1218      | 497.3607 | 514.6926 (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                                                               | 725.2565 | 707.3847 | 639.6802 | 525.6189 | 399.6443 | 265.0138 | 176.6017 | 184.8205 | 288.9422 | 446.7377      | 597.0401 | 717.3903 (97)  |
| Space heating kWh                                                              | 139.9239 | 75.1514  | 42.7558  | 14.2845  | 4.0359   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 16.8263       | 71.7692  | 150.8071 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 515.5540       |
| 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                                                              | 139.9239 | 75.1514  | 42.7558  | 14.2845  | 4.0359   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 16.8263       | 71.7692  | 150.8071 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 515.5540       |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 8.3383 (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 %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 90.0000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 139.9239 | 75.1514  | 42.7558  | 14.2845  | 4.0359   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 16.8263  | 71.7692  | 150.8071 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 90.0000  | 90.0000  | 90.0000 (210)   |
| Space heating fuel (main heating system)                                                                     | 155.4710 | 83.5015  | 47.5064  | 15.8716  | 4.4844   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 18.6959  | 79.7436  | 167.5634 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 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                                                                                    | 213.5218 | 188.9344 | 201.0627 | 177.6985 | 172.8608 | 156.4303 | 154.9087 | 160.7077 | 162.0742 | 179.9201 | 190.3135 | 211.3188 (64)   |
| Efficiency of water heater (217)m                                                                            | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000  | 90.0000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 180.6254 | 158.7855 | 166.7820 | 142.6482 | 135.4466 | 119.0169 | 115.4998 | 121.9431 | 125.2879 | 143.2903 | 156.6650 | 178.1777 (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)    |
| Pumps and Fa                                                                                                 | 68.8740  | 62.2087  | 68.8740  | 66.6522  | 68.8740  | 66.6522  | 68.8740  | 68.8740  | 66.6522  | 68.8740  | 66.6522  | 68.8740 (231)   |
| Lighting                                                                                                     | 20.2609  | 16.2540  | 14.6350  | 10.7222  | 8.2821   | 6.7666   | 7.5552   | 9.8206   | 12.7560  | 16.7365  | 18.9039  | 20.8240 (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                                                                           |          |          |          |          |          |          |          |          |          |          |          | 572.8378 (211)  |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 90.0000         |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 1744.1684 (219) |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)                                   |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.6625)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 124.9352 (230a) |
| 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                                                                    |          |          |          |          |          |          |          |          |          |          |          | 810.9352 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |          |          |          | 163.5170 (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                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |

# Full SAP Calculation Printout



|                                     |                 |
|-------------------------------------|-----------------|
| Energy saved or generated           | -0.0000 (236)   |
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 3291.4585 (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                   | 572.8378           | 0.2100                        | 120.2959 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 1744.1684          | 0.2100                        | 366.2754 (264)           |
| Space and water heating                         |                    |                               | 486.5713 (265)           |
| Pumps, fans and electric keep-hot               | 810.9352           | 0.1387                        | 112.4867 (267)           |
| Energy for lighting                             | 163.5170           | 0.1443                        | 23.6006 (268)            |
| Total CO2, kg/year                              |                    |                               | 622.6586 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 10.0700 (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               | 572.8378           | 1.1300                              | 647.3067 (275)             |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 1744.1684          | 1.1300                              | 1970.9103 (278)            |
| Space and water heating                     |                    |                                     | 2618.2171 (279)            |
| Pumps, fans and electric keep-hot           | 810.9352           | 1.5128                              | 1226.7828 (281)            |
| Energy for lighting                         | 163.5170           | 1.5338                              | 250.8079 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4095.8078 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 66.2400 (287)              |

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

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 61.8300 (1b) | x 2.5000 (2b)                   | = 154.5750 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 61.8300      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 154.5750 (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 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                                                                | 2 * 10 = 20.0000 (7a)                              |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                               |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour<br>20.0000 / (5) = 0.1294 (8) |
| Pressure test                                                                                      | Yes                                                |
| Pressure Test Method                                                                               | Blower Door                                        |
| Measured/design AP50                                                                               | 5.0000 (17)                                        |
| Infiltration rate                                                                                  | 0.3794 (18)                                        |
| Number of sides sheltered                                                                          | 2 (19)                                             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20)            |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3225 (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 | 0.4112 | 0.4031 | 0.3950 | 0.3547 | 0.3467 | 0.3064 | 0.3064 | 0.2983 | 0.3225 | 0.3467 | 0.3628 | 0.3789 (22b) |
| Effective ac    | 0.5845 | 0.5812 | 0.5780 | 0.5629 | 0.5601 | 0.5469 | 0.5469 | 0.5445 | 0.5520 | 0.5601 | 0.5658 | 0.5718 (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)                      |             |                | 15.4600       | 1.1450           | 17.7023                      |                   | (27)          |
| External Walls                                    | 55.7500     | 15.4600        | 40.2900       | 0.1800           | 7.2522                       |                   | (29a)         |
| Total net area of external elements Aum(A, m2)    |             |                | 55.7500       |                  |                              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = 24.9545 |                   | (33)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                              |                   | 121.8324 (35) |
| List of Thermal Bridges                           |             |                |               |                  |                              |                   |               |
| K1 Element                                        |             |                |               | Length           | Psi-value                    | Total             |               |

# Full SAP Calculation Printout



|                                                            |         |                       |              |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)           | 8.9500  | 0.0500                | 0.4475       |
| E3 Sill                                                    | 3.9500  | 0.0500                | 0.1975       |
| E4 Jamb                                                    | 15.6000 | 0.0500                | 0.7800       |
| E18 Party wall between dwellings                           | 5.0000  | 0.0600                | 0.3000       |
| E7 Party floor between dwellings (in blocks of flats)      | 41.0000 | 0.0700                | 2.8700       |
| E16 Corner (normal)                                        | 5.0000  | 0.0900                | 0.4500       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 5.0450 (36)  |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 29.9995 (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                                                 | 29.8166 | 29.6491 | 29.4850 | 28.7142 | 28.5700 | 27.8986 | 27.8986 | 27.7743 | 28.1572 | 28.5700 | 28.8617 | 29.1667 (38) |
| Average = Sum(39)m / 12 =                                           | 59.8160 | 59.6486 | 59.4845 | 58.7137 | 58.5695 | 57.8981 | 57.8981 | 57.7738 | 58.1567 | 58.5695 | 58.8612 | 59.1662 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 58.7130      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 0.9674  | 0.9647  | 0.9621  | 0.9496  | 0.9473  | 0.9364  | 0.9364  | 0.9344  | 0.9406  | 0.9473  | 0.9520  | 0.9569 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

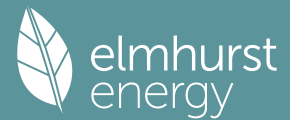
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| 4. Water heating energy requirements (kWh/year)                 |          |          |          |          |          |          |          |          |          |          |          |                |
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          | 2.0329 (42)    |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (42a)   |
| Hot water usage for baths                                       | 67.1953  | 66.1973  | 64.7920  | 62.2009  | 60.2606  | 58.1092  | 56.9472  | 58.3427  | 59.8621  | 62.1641  | 64.8087  | 66.9681 (42b)  |
| Hot water usage for other uses                                  | 35.4487  | 34.1596  | 32.8706  | 31.5815  | 30.2925  | 29.0035  | 29.0035  | 30.2925  | 31.5815  | 32.8706  | 34.1596  | 35.4487 (42c)  |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          | 94.5267 (43)   |
| Daily hot water use                                             | 102.6439 | 100.3569 | 97.6626  | 93.7824  | 90.5531  | 87.1127  | 85.9506  | 88.6352  | 91.4436  | 95.0347  | 98.9683  | 102.4168 (44)  |
| Energy content (annual)                                         | 162.5629 | 142.9070 | 150.1038 | 128.3834 | 121.9019 | 107.1152 | 103.9498 | 109.7488 | 112.7591 | 128.9612 | 140.9985 | 160.3599 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                          | 24.3844  | 21.4360  | 22.5156  | 19.2575  | 18.2853  | 16.0673  | 15.5925  | 16.4623  | 16.9139  | 19.3442  | 21.1498  | 24.0540 (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  | 49.7678  | 46.2489  | 46.1449  | 42.9597  | 43.7995  | 45.1675  | 45.0955  | 48.4287  | 48.8063  | 50.9589 (61)   |
| Total heat required for water heating calculated for each month | 213.5218 | 188.9344 | 199.8716 | 174.6323 | 168.0468 | 150.0749 | 147.7493 | 154.9163 | 157.8546 | 177.3899 | 189.8047 | 211.3188 (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                                                 | 213.5218 | 188.9344 | 199.8716 | 174.6323 | 168.0468 | 150.0749 | 147.7493 | 154.9163 | 157.8546 | 177.3899 | 189.8047 | 211.3188 (64)  |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          | 2134.1154 (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                        | 66.7919  | 59.0234  | 62.3514  | 54.2497  | 52.0686  | 46.3557  | 45.5132  | 47.7834  | 48.7663  | 54.9868  | 59.0836  | 66.0594 (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                                                                               | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 | 101.6437 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473  | 89.5473 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 177.5375 | 179.3798 | 174.7373 | 164.8540 | 152.3781 | 140.6524 | 132.8190 | 130.9767 | 135.6192 | 145.5026 | 157.9785 | 169.7041 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644  | 33.1644 (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)                                 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 | -81.3150 (71) |
| Water heating gains (Table 5)                                                       | 89.7740  | 87.8325  | 83.8057  | 75.3468  | 69.9847  | 64.3830  | 61.1736  | 64.2249  | 67.7309  | 73.9070  | 82.0605  | 88.7895 (72)  |
| Total internal gains                                                                | 413.3520 | 422.8470 | 404.5834 | 389.2261 | 368.4032 | 351.0607 | 337.0331 | 338.2421 | 349.3755 | 365.4499 | 389.0643 | 404.5340 (73) |

| 6. Solar gains |  |  |  |            |                                |                                   |                                    |                              |               |          |          |          |          |          |               |
|----------------|--|--|--|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|----------|----------|----------|----------|----------|---------------|
| [Jan]          |  |  |  | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |          |          |          |          |          |               |
| North          |  |  |  | 1.8900     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 6.1419 (74)   |          |          |          |          |          |               |
| East           |  |  |  | 4.1100     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 24.6695 (76)  |          |          |          |          |          |               |
| South          |  |  |  | 9.4600     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 135.1648 (78) |          |          |          |          |          |               |
|                |  |  |  |            |                                |                                   |                                    |                              |               |          |          |          |          |          |               |
| Solar gains    |  |  |  | 165.9763   | 281.3616                       | 381.4004                          | 466.6455                           | 517.3124                     | 511.2206      | 493.8487 | 456.4011 | 410.9749 | 309.9983 | 198.5533 | 142.2021 (83) |
| Total gains    |  |  |  | 579.3283   | 704.2086                       | 785.9838                          | 855.8716                           | 885.7155                     | 862.2814      | 830.8818 | 794.6432 | 760.3504 | 675.4483 | 587.6176 | 546.7361 (84) |

|                                               |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|
| 7. Mean internal temperature (heating season) |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|

# Full SAP Calculation Printout



|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| 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                                                                         | 34.9818 | 35.0800 | 35.1768 | 35.6386 | 35.7263 | 36.1406 | 36.1406 | 36.2184 | 35.9799                   | 35.7263 | 35.5493 | 35.3660      |
| alpha                                                                       | 3.3321  | 3.3387  | 3.3451  | 3.3759  | 3.3818  | 3.4094  | 3.4094  | 3.4146  | 3.3987                    | 3.3818  | 3.3700  | 3.3577       |
| util living area                                                            | 0.9245  | 0.8720  | 0.8042  | 0.6951  | 0.5631  | 0.4156  | 0.3028  | 0.3291  | 0.4975                    | 0.7304  | 0.8792  | 0.9347 (86)  |
| MIT                                                                         | 19.5692 | 19.9298 | 20.2873 | 20.6413 | 20.8571 | 20.9621 | 20.9902 | 20.9868 | 20.9284                   | 20.6401 | 20.0642 | 19.5036 (87) |
| Th 2                                                                        | 20.1106 | 20.1128 | 20.1151 | 20.1255 | 20.1275 | 20.1367 | 20.1367 | 20.1384 | 20.1331                   | 20.1275 | 20.1235 | 20.1194 (88) |
| util rest of house                                                          | 0.9140  | 0.8560  | 0.7812  | 0.6625  | 0.5203  | 0.3637  | 0.2449  | 0.2695  | 0.4429                    | 0.6933  | 0.8613  | 0.9255 (89)  |
| MIT 2                                                                       | 18.4614 | 18.9048 | 19.3377 | 19.7585 | 19.9968 | 20.1087 | 20.1314 | 20.1310 | 20.0767                   | 19.7697 | 19.0863 | 18.3863 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.5256 (91)  |
| MIT                                                                         | 19.0437 | 19.4436 | 19.8369 | 20.2225 | 20.4490 | 20.5573 | 20.5828 | 20.5808 | 20.5244                   | 20.2272 | 19.6003 | 18.9736 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 19.0437 | 19.4436 | 19.8369 | 20.2225 | 20.4490 | 20.5573 | 20.5828 | 20.5808 | 20.5244                   | 20.2272 | 19.6003 | 18.9736 (93) |

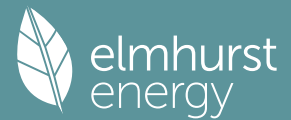
## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.8991   | 0.8424   | 0.7734   | 0.6663   | 0.5364   | 0.3893   | 0.2750   | 0.3003   | 0.4680   | 0.6978        | 0.8491   | 0.9110 (94)    |
| Useful gains                                                                   | 520.8543 | 593.2337 | 607.9018 | 570.2377 | 475.0936 | 335.6485 | 228.4826 | 238.6442 | 355.8577 | 471.3393      | 498.9728 | 498.0746 (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                                                               | 881.9122 | 867.5046 | 793.3369 | 664.7871 | 512.4228 | 344.9135 | 230.5973 | 241.5412 | 373.6230 | 563.8618      | 735.7827 | 874.0980 (97)  |
| Space heating kWh                                                              | 268.6270 | 184.3100 | 137.9637 | 68.0756  | 27.7729  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 68.8367       | 170.5031 | 279.7614 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1205.8506      |
| 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                                                              | 268.6270 | 184.3100 | 137.9637 | 68.0756  | 27.7729  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 68.8367       | 170.5031 | 279.7614 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1205.8506      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 19.5027 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          |                 | 92.4000 (206)    |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (207)     |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (208)     |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |                  |
| Space heating requirement                                                                            | 268.6270 | 184.3100 | 137.9637 | 68.0756  | 27.7729  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 68.8367  | 170.5031 | 279.7614 (98)   |                  |
| Space heating efficiency (main heating system 1)                                                     | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)   |                  |
| Space heating fuel (main heating system)                                                             | 290.7219 | 199.4697 | 149.3114 | 73.6749  | 30.0573  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 74.4986  | 184.5272 | 302.7721 (211)  |                  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |                  |
| Space heating fuel (main heating system 2)                                                           | 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                                                                            | 213.5218 | 188.9344 | 199.8716 | 174.6323 | 168.0468 | 150.0749 | 147.7493 | 154.9163 | 157.8546 | 177.3899 | 189.8047 | 211.3188 (64)   |                  |
| Efficiency of water heater (217)m                                                                    | 84.8745  | 84.3283  | 83.6028  | 82.5396  | 81.4171  | 80.3000  | 80.3000  | 80.3000  | 80.3000  | 82.5321  | 84.1523  | 84.9835 (216)   |                  |
| Fuel for water heating, kWh/month                                                                    | 251.5736 | 224.0461 | 239.0729 | 211.5740 | 206.4025 | 186.8928 | 183.9967 | 192.9220 | 196.5811 | 214.9345 | 225.5490 | 248.6588 (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)    |                  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041 (231)    |                  |
| Lighting                                                                                             | 18.6062  | 14.9266  | 13.4397  | 9.8465   | 7.6057   | 6.2139   | 6.9382   | 9.0185   | 11.7142  | 15.3696  | 17.3600  | 19.1233 (232)   |                  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -21.1316 | -30.8063 | -45.7807 | -53.2878 | -59.0508 | -55.7149 | -55.0473 | -51.1878 | -44.6360 | -36.0433 | -23.5947 | -18.1540 (233a) |                  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 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)                  | 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) | 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)                                        | -9.0455  | -19.2975 | -38.8520 | -59.0785 | -78.8166 | -79.4317 | -78.4826 | -66.1198 | -48.0386 | -27.8204 | -12.1504 | -7.1320 (233b)  |                  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 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)                  | 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) | 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                                                                   |          |          |          |          |          |          |          |          |          |          |          |                 | 1305.0331 (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                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 | 2582.2039 (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)                                                  |          |          |          |          |          |          |          |          |          |          |          |                 | 150.1624 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |                  |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 | -1018.7009 (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)    |

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|                                     |                 |
|-------------------------------------|-----------------|
| Energy used                         | 0.0000 (237)    |
| Total delivered energy for all uses | 3104.6985 (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                 | 1305.0331          | 0.2100                        | 274.0569 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2582.2039          | 0.2100                        | 542.2628 (264)           |
| Space and water heating                       |                    |                               | 816.3198 (265)           |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 150.1624           | 0.1443                        | 21.6731 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -494.4351          | 0.1339                        | -66.1912                 |
| PV Unit electricity exported                  | -524.2658          | 0.1255                        | -65.8161                 |
| Total                                         |                    |                               | -132.0073 (269)          |
| Total CO2, kg/year                            |                    |                               | 717.9148 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.6100 (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               | 1305.0331          | 1.1300                              | 1474.6874 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2582.2039          | 1.1300                              | 2917.8904 (278)            |
| Space and water heating                     |                    |                                     | 4392.5778 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 150.1624           | 1.5338                              | 230.3240 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -494.4351          | 1.4947                              | -739.0466                  |
| PV Unit electricity exported                | -524.2658          | 0.4608                              | -241.5818                  |
| Total                                       |                    |                                     | -980.6284 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 3772.3742 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 61.0100 (287)              |