

# Full SAP Calculation Printout



|                                    |                                                               |               |         |                |            |
|------------------------------------|---------------------------------------------------------------|---------------|---------|----------------|------------|
| Plot Reference                     | UNIT 02                                                       |               |         | Issued on Date | 08/07/2026 |
| Assessment Reference               | 001                                                           | Plot Type Ref | UNIT 02 |                |            |
| Plot Address                       | UNIT 02, Stoney Wood Quarter, 34 The Fairway, LONDON, NW7 3HS |               |         | SAP Version    | 10.2       |
|                                    |                                                               |               |         |                |            |
| SAP Rating                         | 82 B                                                          | DER           | 3.45    | TER            | 14.31      |
| Environmental                      | 97 A                                                          | % DER < TER   |         |                | 75.89      |
| CO <sub>2</sub> Emissions (t/year) | 0.26                                                          | DFEE          | 34.22   | TFEE           | 37.79      |
| Compliance Check                   | See BREL                                                      | % DFEE < TFEE |         |                | 9.44       |
| % DPER < TPER                      | 52.29                                                         | DPER          | 36.92   | TPER           | 77.38      |
|                                    |                                                               |               |         |                |            |
| Assessor Details                   | Mr. Ondrej Gajdos                                             |               |         | Assessor ID    | W452-0001  |
| 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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Basement floor                                         | 49.2000 (1a)              | x 2.6500 (2a)                   | = 130.3800 (1a) - (3a)      |
| Ground floor                                           | 33.2000 (1b)              | x 2.8000 (2b)                   | = 92.9600 (1b) - (3b)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 82.4000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 223.3400 (5)              |

## 2. Ventilation rate

|                                                                                                         |                                                                                                                                     |               |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 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) =                                                                               |               |
| Pressure test                                                                                           | 0.0000 / (5) =                                                                                                                      | 0.0000 (8)    |
| Pressure Test Method                                                                                    | Yes                                                                                                                                 |               |
| Measured/design AP50                                                                                    | Blower Door                                                                                                                         | 3.0000 (17)   |
| Infiltration rate                                                                                       |                                                                                                                                     | 0.1500 (18)   |
| Number of sides sheltered                                                                               | 4                                                                                                                                   | (19)          |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] =                                                                                                         | 0.7000 (20)   |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) =                                                                                                                | 0.1050 (21)   |
| Wind speed                                                                                              | Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 | (22)          |
| Wind factor                                                                                             | 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750                                                 | (22a)         |
| Adj infilt rate                                                                                         | 0.1339 0.1313 0.1286 0.1155 0.1129 0.0997 0.0997 0.0971 0.1050 0.1129 0.1181 0.1234                                                 | (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) =            |                                                                                                                                     | 81.0000 (23c) |
| Effective ac                                                                                            | 0.2289 0.2262 0.2236 0.2105 0.2079 0.1947 0.1947 0.1921 0.2000 0.2079 0.2131 0.2184                                                 | (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   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| 1                                                           |                         |                            | 27.6700                   | 0.7940                        | 21.9688      |                                | (27)            |
| 1rl                                                         |                         |                            | 0.4400                    | 0.7940                        | 0.3493       |                                | (27a)           |
| parking below                                               |                         |                            | 49.2000                   | 0.1000                        | 4.9200       | 75.0000                        | 3690.0001 (28b) |
| exposed wall                                                | 32.9200                 | 27.6700                    | 5.2500                    | 0.1500                        | 0.7875       | 60.0000                        | 314.9999 (29a)  |
| basement wall                                               | 14.0450                 |                            | 14.0450                   | 0.1500                        | 2.1068       | 9.0000                         | 126.4050 (29a)  |
| garage wall                                                 | 11.0000                 |                            | 11.0000                   | 0.3000                        | 3.3000       | 9.0000                         | 99.0000 (29a)   |
| terrace above LGF                                           | 13.8000                 | 0.4400                     | 13.3600                   | 0.1000                        | 1.3360       | 9.0000                         | 120.2400 (30)   |
| terrace above GF                                            | 1.5000                  |                            | 1.5000                    | 0.1000                        | 0.1500       | 9.0000                         | 13.5000 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 122.4650                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 34.9184      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| pw                                                          |                         |                            | 97.2300                   | 0.0000                        | 0.0000       | 110.0000                       | 10695.3004 (32) |
| pc                                                          |                         |                            | 31.7000                   |                               |              | 30.0000                        | 951.0000 (32b)  |
| iw                                                          |                         |                            | 162.2900                  |                               |              | 9.0000                         | 1460.6099 (32c) |



| 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                                                                               | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 113.1756  | 125.3015  | 113.1756  | 116.9481  | 113.1756  | 116.9481  | 113.1756  | 113.1756  | 116.9481  | 113.1756  | 116.9481  | 113.1756  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 224.3833  | 226.7117  | 220.8442  | 208.3530  | 192.5851  | 177.7656  | 167.8652  | 165.5368  | 171.4043  | 183.8954  | 199.6633  | 214.4829  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | (71) |
| Water heating gains (Table 5)                                                       | 155.1075  | 152.6392  | 147.8842  | 137.4627  | 131.0793  | 124.4070  | 120.3088  | 123.6947  | 127.6644  | 135.0681  | 145.0583  | 153.7750  | (72) |
| Total internal gains                                                                | 553.2687  | 565.2547  | 542.5064  | 523.3662  | 497.4424  | 479.7230  | 461.9520  | 463.0094  | 476.6192  | 492.7415  | 522.2721  | 542.0359  | (73) |

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## 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       |          |          |          | 7.3800     | 10.6334                        | 0.5300                            | 0.7000                             | 0.7700                       | 20.1760 (74) |          |          |               |
| Northeast   |          |          |          | 14.9600    | 11.2829                        | 0.5300                            | 0.7000                             | 0.7700                       | 43.3971 (75) |          |          |               |
| Northwest   |          |          |          | 5.3300     | 11.2829                        | 0.5300                            | 0.7000                             | 0.7700                       | 15.4617 (81) |          |          |               |
| Horizontal  |          |          |          | 0.4400     | 26.0000                        | 0.5300                            | 0.7000                             | 1.0000                       | 3.8198 (82)  |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 82.8546  | 166.2997 | 295.4797 | 481.7766   | 646.4923                       | 689.1670                          | 644.7003                           | 514.3481                     | 358.6953     | 202.0099 | 103.7976 | 67.9720 (83)  |
| Total gains | 636.1233 | 731.5544 | 837.9861 | 1005.1428  | 1143.9347                      | 1168.8900                         | 1106.6522                          | 977.3575                     | 835.3145     | 694.7513 | 626.0696 | 610.0079 (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                                                                         | 80.6811                   | 80.9287 | 81.1778 | 82.4467 | 82.7053 | 84.0229 | 84.0229 | 84.2914 | 83.4908 | 82.7053 | 82.1898 | 81.6807      |
| alpha                                                                       | 6.3787                    | 6.3952  | 6.4119  | 6.4964  | 6.5137  | 6.6015  | 6.6015  | 6.6194  | 6.5661  | 6.5137  | 6.4793  | 6.4454       |
| util living area                                                            | 0.9839                    | 0.9623  | 0.8985  | 0.7134  | 0.4987  | 0.3323  | 0.2414  | 0.2848  | 0.5020  | 0.8300  | 0.9622  | 0.9871 (86)  |
| MIT                                                                         | 20.3375                   | 20.5207 | 20.7558 | 20.9510 | 20.9950 | 20.9997 | 21.0000 | 20.9999 | 20.9963 | 20.8996 | 20.5976 | 20.3097 (87) |
| Th 2                                                                        | 20.2816                   | 20.2837 | 20.2857 | 20.2960 | 20.2980 | 20.3083 | 20.3083 | 20.3104 | 20.3042 | 20.2980 | 20.2939 | 20.2898 (88) |
| util rest of house                                                          | 0.9800                    | 0.9538  | 0.8791  | 0.6791  | 0.4620  | 0.2965  | 0.2035  | 0.2422  | 0.4525  | 0.7942  | 0.9523  | 0.9839 (89)  |
| MIT 2                                                                       | 19.5163                   | 19.7456 | 20.0290 | 20.2511 | 20.2943 | 20.3082 | 20.3083 | 20.3104 | 20.3019 | 20.2058 | 19.8522 | 19.4881 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         | 0.3070 (91)  |
| MIT                                                                         | 19.7684                   | 19.9836 | 20.2521 | 20.4660 | 20.5094 | 20.5205 | 20.5207 | 20.5221 | 20.5151 | 20.4188 | 20.0811 | 19.7403 (92) |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.7684                   | 19.9836 | 20.2521 | 20.4660 | 20.5094 | 20.5205 | 20.5207 | 20.5221 | 20.5151 | 20.4188 | 20.0811 | 19.7403 (93) |

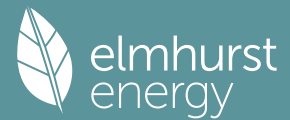
## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                            |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------|
| Utilisation                                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                        |
|                                                                                | 0.9765   | 0.9496   | 0.8781   | 0.6876   | 0.4731   | 0.3075   | 0.2151   | 0.2553   | 0.4676   | 0.8007   | 0.9488   | 0.9808 (94)                |
| Useful gains                                                                   | 621.2055 | 694.7190 | 735.8264 | 691.1114 | 541.2052 | 359.4037 | 238.0662 | 249.4834 | 390.5709 | 556.3181 | 593.9982 | 598.2884 (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                                                               | 978.1855 | 950.9297 | 864.3296 | 715.7410 | 543.4511 | 359.5074 | 238.0735 | 249.5054 | 392.0243 | 605.7202 | 805.8216 | 970.7062 (97)              |
| Space heating kWh                                                              | 265.5931 | 172.1736 | 95.6063  | 17.7333  | 1.6710   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 36.7551  | 152.5129 | 277.0788 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |          |          | 1019.1243                  |
| 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                                                              | 265.5931 | 172.1736 | 95.6063  | 17.7333  | 1.6710   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 36.7551  | 152.5129 | 277.0788 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |          |          | 1019.1243                  |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          |          |          | (98c) / (4) = 12.3680 (99) |

## 9b. Energy requirements

|                                                                                         |          |          |          |          |          |          |          |          |          |          |          |                 |
|-----------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (301)    |
| Fraction of space heat from community system                                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (302)    |
| Fraction of heat from community Heat pump-Space and Water                               |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (303a)   |
| Factor for control and charging method (Table 4c(3)) for space heating                  |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (305)    |
| Factor for charging method (Table 4c(3)) for water heating                              |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (305a)   |
| Distribution loss factor (Table 12c) for community heating system                       |          |          |          |          |          |          |          |          |          |          |          | 1.5000 (306)    |
| Efficiency of secondary/supplementary heating system, %                                 |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating:                                                                          |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating requirement                                                               | 265.5931 | 172.1736 | 95.6063  | 17.7333  | 1.6710   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 36.7551  | 152.5129 | 277.0788 (98)   |
| Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50                                   |          |          |          |          |          |          |          |          |          |          |          |                 |
| 307a                                                                                    | 398.3897 | 258.2605 | 143.4095 | 26.6000  | 2.5064   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 55.1327  | 228.7693 | 415.6182        |
| Space heating requirement                                                               | 398.3897 | 258.2605 | 143.4095 | 26.6000  | 2.5064   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 55.1327  | 228.7693 | 415.6182 (307)  |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (308)    |
| Space heating fuel for secondary/supplementary system                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (309)    |
| Water heating                                                                           |          |          |          |          |          |          |          |          |          |          |          |                 |
| Annual water heating requirement                                                        | 269.3476 | 238.2930 | 253.1849 | 222.4507 | 215.5822 | 194.1796 | 191.4823 | 199.0585 | 201.2334 | 224.5075 | 238.8983 | 266.3661 (64)   |
| Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50                                   |          |          |          |          |          |          |          |          |          |          |          |                 |
| 310a                                                                                    | 404.0214 | 357.4395 | 379.7773 | 333.6761 | 323.3733 | 291.2694 | 287.2235 | 298.5878 | 301.8501 | 336.7612 | 358.3474 | 399.5491        |
| Water heating fuel                                                                      | 404.0214 | 357.4395 | 379.7773 | 333.6761 | 323.3733 | 291.2694 | 287.2235 | 298.5878 | 301.8501 | 336.7612 | 358.3474 | 399.5491 (310)  |
| Cooling System Energy Efficiency Ratio                                                  |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (314)    |
| Space coolin                                                                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (315)    |
| Pumps and Fa                                                                            | 16.0372  | 14.4852  | 16.0372  | 15.5199  | 16.0372  | 15.5199  | 16.0372  | 16.0372  | 15.5199  | 16.0372  | 15.5199  | 16.0372 (331)   |
| Lighting                                                                                | 23.5157  | 18.8651  | 16.9860  | 12.4446  | 9.6126   | 7.8536   | 8.7689   | 11.3982  | 14.8051  | 19.4251  | 21.9406  | 24.1692 (332)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                           |          |          |          |          |          |          |          |          |          |          |          |                 |
| (333a)m                                                                                 | -3.4658  | -6.1856  | -11.4836 | -16.2741 | -20.4537 | -20.2125 | -19.7816 | -16.9642 | -12.6822 | -8.0924  | -4.1704  | -2.8264 (333a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                 |          |          |          |          |          |          |          |          |          |          |          |                 |
| (334a)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 (334a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)     |          |          |          |          |          |          |          |          |          |          |          |                 |
| (335a)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 (335a)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                           |          |          |          |          |          |          |          |          |          |          |          |                 |
| (333b)m                                                                                 | -0.4030  | -1.0720  | -2.8012  | -5.3259  | -8.1159  | -8.5875  | -8.3416  | -6.3974  | -3.8778  | -1.7284  | -0.5816  | -0.2984 (333b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                 |          |          |          |          |          |          |          |          |          |          |          |                 |
| (334b)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 (334b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)     |          |          |          |          |          |          |          |          |          |          |          |                 |
| (335b)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 (335b)   |
| Annual totals kWh/year                                                                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - community heating                                                  |          |          |          |          |          |          |          |          |          |          |          | 1528.6864 (307) |
| Space heating fuel - secondary                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (309)    |
| Water heating fuel - community heating                                                  |          |          |          |          |          |          |          |          |          |          |          | 4071.8761 (310) |

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|                                                                                                               |                 |
|---------------------------------------------------------------------------------------------------------------|-----------------|
| Efficiency of water heater                                                                                    | 0.0000 (311)    |
| Electricity used for heat distribution                                                                        | 15.2869 (313)   |
| Space cooling fuel                                                                                            | 0.0000 (321)    |
| Electricity for pumps and fans:<br>(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.6930) |                 |
| mechanical ventilation fans (SFP = 0.6930)                                                                    | 188.8250 (330a) |
| Total electricity for the above, kWh/year                                                                     | 188.8250 (331)  |
| Electricity for lighting (calculated in Appendix L)                                                           | 189.7848 (332)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                 |                 |
| PV generation                                                                                                 | -190.1232 (333) |
| Wind generation                                                                                               | 0.0000 (334)    |
| Hydro-electric generation (Appendix N)                                                                        | 0.0000 (335a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                | 0.0000 (335)    |
| Appendix Q - special features                                                                                 |                 |
| Energy saved or generated                                                                                     | -0.0000 (336)   |
| Energy used                                                                                                   | 0.0000 (337)    |
| Total delivered energy for all uses                                                                           | 5789.0491 (338) |

## 12b. Carbon dioxide emissions - Community heating scheme

|                                                         | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Efficiency of heat source Heat pump                     |                    |                               | 330.0000 (367)           |
| Space and Water heating from Heat pump                  | 1697.1402          | 0.1584                        | 73.3708 (367)            |
| Electrical energy for heat distribution (space & water) | 15.2869            | 0.0000                        | 8.1581 (372)             |
| Overall CO2 factor for heat network                     |                    |                               | 0.0456 (386)             |
| Total CO2 associated with community systems             |                    |                               | 255.3746 (373)           |
| Space and water heating                                 |                    |                               | 255.3746 (376)           |
| Pumps, fans and electric keep-hot                       | 188.8250           | 0.1387                        | 26.1924 (378)            |
| Energy for lighting                                     | 189.7848           | 0.1443                        | 27.3918 (379)            |
| Energy saving/generation technologies                   |                    |                               |                          |
| PV Unit electricity used in dwelling                    | -142.5924          | 0.1304                        | -18.5982                 |
| PV Unit electricity exported                            | -47.5308           | 0.1205                        | -5.7295                  |
| Total                                                   |                    |                               | -24.3277 (380)           |
| Total CO2, kg/year                                      |                    |                               | 284.6311 (383)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER)         |                    |                               | 3.4500 (384)             |

## 13b. Primary energy - Community heating scheme

|                                                         | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Efficiency of heat source Heat pump                     |                    |                                     | 330.0000 (467a)            |
| Space and Water heating from Heat pump                  | 1697.1402          | 1.5863                              | 734.8225 (467)             |
| Electrical energy for heat distribution (space & water) | 15.2869            | 0.0000                              | 86.1809 (472)              |
| Overall CO2 factor for heat network                     |                    |                                     | 0.4817 (486)               |
| Total CO2 associated with community systems             |                    |                                     | 2697.7232 (473)            |
| Space and water heating                                 |                    |                                     | 2697.7232 (476)            |
| Pumps, fans and electric keep-hot                       | 188.8250           | 1.5128                              | 285.6545 (478)             |
| Energy for lighting                                     | 189.7848           | 1.5338                              | 291.0982 (479)             |
| Energy saving/generation technologies                   |                    |                                     |                            |
| PV Unit electricity used in dwelling                    | -142.5924          | 1.4818                              | -211.2932                  |
| PV Unit electricity exported                            | -47.5308           | 0.4422                              | -21.0179                   |
| Total                                                   |                    |                                     | -232.3111 (480)            |
| Total Primary energy kWh/year                           |                    |                                     | 3042.1649 (483)            |
| Dwelling Primary energy Rate (DPER)                     |                    |                                     | 36.9200 (484)              |

## 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)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Basement floor                                         | 49.2000 (1a) | x 2.6500 (2a)                   | = 130.3800 (1a) - (3a) |
| Ground floor                                           | 33.2000 (1b) | x 2.8000 (2b)                   | = 92.9600 (1b) - (3b)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 82.4000      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 223.3400 (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                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1343 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |

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Measured/design AP50 5.0000 (17)  
 Infiltration rate 0.3843 (18)  
 Number of sides sheltered 4 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7000 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2690 (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 |        |        |        |        |        |        |        |        |        |        |        |        |       |
| Effective ac    | 0.3430 | 0.3363 | 0.3296 | 0.2959 | 0.2892 | 0.2556 | 0.2556 | 0.2489 | 0.2690 | 0.2892 | 0.3027 | 0.3161 | (22b) |
|                 | 0.5588 | 0.5565 | 0.5543 | 0.5438 | 0.5418 | 0.5327 | 0.5327 | 0.5310 | 0.5362 | 0.5418 | 0.5458 | 0.5500 | (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 |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                  |              |                   |               |       |
| TER Opening Type                               |             |                | 20.2900       | 1.1450           | 23.2328      |                   |               | (27)  |
| TER Roof Window                                |             |                | 0.3200        | 1.1450           | 0.5094       |                   |               | (27a) |
| parking below                                  |             |                | 49.2000       | 0.1300           | 6.3960       |                   |               | (28b) |
| exposed wall                                   | 32.9200     | 20.2900        | 12.6300       | 0.1800           | 2.2734       |                   |               | (29a) |
| basement wall                                  | 14.0450     |                | 14.0450       | 0.1800           | 2.5281       |                   |               | (29a) |
| garage wall                                    | 11.0000     |                | 11.0000       | 0.1800           | 1.9800       |                   |               | (29a) |
| terrace above LGF                              | 13.8000     | 0.3200         | 13.4800       | 0.1100           | 1.4828       |                   |               | (30)  |
| terrace above GF                               | 1.5000      |                | 1.5000        | 0.1100           | 0.1650       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 122.4650      |                  |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 38.5675      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                  |              |                   |               |       |
| pw                                             |             |                | 97.2300       | 0.0000           | 0.0000       |                   |               | (32)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 222.9060 (35)

## List of Thermal Bridges

|                                                                  | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| K1 Element                                                       | 10.4200 | 0.0500    | 0.5210  |  |
| E2 Other lintels (including other steel lintels)                 | 10.4200 | 0.0500    | 0.5210  |  |
| E3 Sill                                                          | 31.8000 | 0.0500    | 1.5900  |  |
| E4 Jamb                                                          | 16.6000 | 0.3200    | 5.3120  |  |
| E20 Exposed floor (normal)                                       | 1.3000  | 0.0000    | 0.0000  |  |
| E6 Intermediate floor within a dwelling                          | 0.9000  | 0.0700    | 0.0630  |  |
| E7 Party floor between dwellings (in blocks of flats)            | 2.6000  | 0.2400    | 0.6240  |  |
| E24 Eaves (insulation at ceiling level - inverted)               | 3.0000  | 0.2400    | 0.7200  |  |
| E24 Eaves (insulation at ceiling level - inverted)               | 11.0000 | 0.0800    | 0.8800  |  |
| E14 Flat roof                                                    | 8.1000  | 0.0900    | 0.7290  |  |
| E16 Corner (normal)                                              | 10.7500 | -0.0900   | -0.9675 |  |
| E17 Corner (inverted - internal area greater than external area) | 5.4500  | 0.0600    | 0.3270  |  |
| E18 Party wall between dwellings                                 | 7.6500  | 0.0600    | 0.4590  |  |
| E25 Staggered party wall between dwellings                       |         |           |         |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.7785 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 49.3460 (37)

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

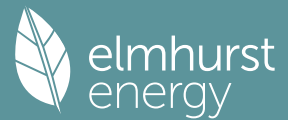
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 41.1868 | 41.0185 | 40.8534 | 40.0783 | 39.9333 | 39.2582 | 39.2582 | 39.1332 | 39.5182 | 39.9333 | 40.2267 | 40.5334 | (38) |
| Heat transfer coeff       | 90.5328 | 90.3645 | 90.1994 | 89.4243 | 89.2793 | 88.6042 | 88.6042 | 88.4791 | 88.8642 | 89.2793 | 89.5727 | 89.8794 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 89.4236 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.0987 | 1.0967 | 1.0947 | 1.0852 | 1.0835 | 1.0753 | 1.0753 | 1.0738 | 1.0784 | 1.0835 | 1.0870 | 1.0908 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0852 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.5068 (42)    |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 66.2509                                                                        | 65.2553  | 63.8045  | 61.0286  | 58.9801  | 56.6956  | 55.3971  | 56.8369  | 58.4152  | 60.8681  | 63.7036  | 65.9971  | 65.9971  | (42a)          |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 28.6133                                                                        | 28.1883  | 27.5899  | 26.4865  | 25.6604  | 24.7442  | 24.2494  | 24.8436  | 25.4906  | 26.4709  | 27.5970  | 28.5165  | 28.5165  | (42b)          |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 40.3024                                                                        | 38.8368  | 37.3713  | 35.9058  | 34.4402  | 32.9747  | 32.9747  | 34.4402  | 35.9058  | 37.3713  | 38.8368  | 40.3024  | 40.3024  | (42c)          |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          |          | 124.2487 (43)  |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 135.1666                                                                       | 132.2805 | 128.7657 | 123.4209 | 119.0806 | 114.4145 | 112.6211 | 116.1207 | 119.8116 | 124.7103 | 130.1374 | 134.8160 | 134.8160 | (44)           |
| Energy conte                                                                   | 214.0708 | 188.3656 | 197.9080 | 168.9570 | 160.3054 | 140.6860 | 143.7817 | 147.7397 | 169.2307 | 185.4046 | 211.0893 | 211.0893 | (45)           |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 32.1106                                                                        | 28.2548  | 29.6862  | 25.3436  | 24.0458  | 21.1029  | 20.4308  | 21.5673  | 22.1610  | 25.3846  | 27.8107  | 31.6634  | 31.6634  | (46)           |
| Water storage loss (or HIU 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   | 0.0000   | (56)           |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (57)           |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)           |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | (61)           |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 265.0297                                                                       | 234.3930 | 248.8670 | 218.2721 | 211.2643 | 190.0010 | 187.1644 | 194.7406 | 197.0548 | 220.1896 | 234.7197 | 262.0482 | 262.0482 | (62)           |
| WWHRS                                                                          | -30.2871 | -26.7862 | -28.0490 | -23.2257 | -21.6455 | -18.5222 | -17.3616 | -18.4623 | -19.1638 | -22.5920 | -25.5940 | -29.7263 | (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                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 234.7425                                                                       | 207.6068 | 220.8180 | 195.0464 | 189.6188 | 171.4788 | 169.8028 | 176.2783 | 177.8910 | 197.5976 | 209.1257 | 232.3219 | 232.3219 | (64)           |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          |          | 2382.3288 (64) |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          |          | 2382 (64)      |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)          |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |          |                |
| 83.9183                                                                        | 74.1384  | 78.5442  | 68.5070  | 66.0413  | 59.1068  | 58.0281  | 60.5472  | 61.4522  | 69.0089  | 73.9758  | 82.9269  | 82.9269  | (65)           |

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

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412  | 125.3412 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 113.1756  | 125.3015  | 113.1756  | 116.9481  | 113.1756  | 116.9481  | 113.1756  | 113.1756  | 116.9481  | 113.1756  | 116.9481  | 113.1756 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 224.3833  | 226.7117  | 220.8442  | 208.3530  | 192.5851  | 177.7656  | 167.8652  | 165.5368  | 171.4043  | 183.8954  | 199.6633  | 214.4829 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341   | 35.5341 (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)                                 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 | -100.2729 (71) |
| Water heating gains (Table 5)                                                       | 112.7934  | 110.3250  | 105.5701  | 95.1486   | 88.7652   | 82.0928   | 77.9947   | 81.3806   | 85.3503   | 92.7539   | 102.7442  | 111.4609 (72)  |
| Total internal gains                                                                | 513.9546  | 525.9406  | 503.1922  | 484.0520  | 458.1282  | 437.4089  | 419.6378  | 420.6953  | 434.3050  | 453.4273  | 482.9579  | 502.7217 (73)  |

## 6. Solar gains

| [Jan]       | Area<br>m2 |          | Solar flux<br>Table 6a<br>W/m2 |          | Specific data<br>or Table 6b |           | Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|------------|----------|--------------------------------|----------|------------------------------|-----------|------------------------------|----------|------------------------------|----------|--------------|---------------|
| North       | 5.4100     |          | 10.6334                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 17.5809 (74) |               |
| Northeast   | 10.9700    |          | 11.2829                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 37.8269 (75) |               |
| Northwest   | 3.9100     |          | 11.2829                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 13.4825 (81) |               |
| Horizontal  | 0.3200     |          | 26.0000                        |          | 0.6300                       |           | 0.7000                       |          | 1.0000                       |          | 3.3022 (82)  |               |
| Solar gains | 72.1925    | 144.8982 | 257.4549                       | 419.7850 | 563.3159                     | 600.5049  | 561.7569                     | 448.1687 | 312.5372                     | 176.0127 | 90.4401      | 59.2253 (83)  |
| Total gains | 586.1471   | 670.8388 | 760.6471                       | 903.8370 | 1021.4441                    | 1037.9137 | 981.3948                     | 868.8640 | 746.8423                     | 629.4400 | 573.3980     | 561.9470 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 56.3560 | 56.4610 | 56.5643 | 57.0546 | 57.1473 | 57.5827 | 57.5827 | 57.6641 | 57.4142 | 57.1473 | 56.9601 | 56.7658      |
| alpha                                                                       | 4.7571  | 4.7641  | 4.7710  | 4.8036  | 4.8098  | 4.8388  | 4.8388  | 4.8443  | 4.8276  | 4.8098  | 4.7973  | 4.7844       |
| util living area                                                            | 0.9932  | 0.9864  | 0.9670  | 0.8929  | 0.7326  | 0.5327  | 0.3945  | 0.4620  | 0.7380  | 0.9446  | 0.9868  | 0.9944 (86)  |
| MIT                                                                         | 19.6635 | 19.8593 | 20.1766 | 20.6037 | 20.8818 | 20.9795 | 20.9961 | 20.9920 | 20.9105 | 20.5184 | 20.0213 | 19.6305 (87) |
| Th 2                                                                        | 20.0019 | 20.0036 | 20.0052 | 20.0129 | 20.0143 | 20.0211 | 20.0211 | 20.0223 | 20.0185 | 20.0143 | 20.0114 | 20.0084 (88) |
| util rest of house                                                          | 0.9913  | 0.9825  | 0.9575  | 0.8645  | 0.6760  | 0.4567  | 0.3081  | 0.3670  | 0.6602  | 0.9232  | 0.9823  | 0.9928 (89)  |
| MIT 2                                                                       | 18.4515 | 18.7012 | 19.1009 | 19.6200 | 19.9185 | 20.0094 | 20.0197 | 20.0193 | 19.9576 | 19.5344 | 18.9145 | 18.4141 (90) |
| Living area fraction                                                        | 18.8236 | 19.0568 | 19.4312 | 19.9220 | 20.2143 | 20.3073 | 20.3195 | 20.3180 | 20.2502 | 19.8365 | 19.2543 | 18.7876 (92) |
| MIT                                                                         | 18.8236 | 19.0568 | 19.4312 | 19.9220 | 20.2143 | 20.3073 | 20.3195 | 20.3180 | 20.2502 | 19.8365 | 19.2543 | 18.7876 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.8236 | 19.0568 | 19.4312 | 19.9220 | 20.2143 | 20.3073 | 20.3195 | 20.3180 | 20.2502 | 19.8365 | 19.2543 | 18.7876 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9880    | 0.9775    | 0.9506    | 0.8615   | 0.6882   | 0.4794   | 0.3347   | 0.3962   | 0.6799   | 0.9185        | 0.9776    | 0.9900 (94)    |
| Useful gains                                                                   | 579.1209  | 655.7402  | 723.0357  | 778.6417 | 702.9146 | 497.5725 | 328.4483 | 344.2153 | 507.7869 | 578.1156      | 560.5607  | 556.3304 (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                                                               | 1314.8635 | 1279.2693 | 1166.3833 | 985.6359 | 760.1491 | 505.6881 | 329.5647 | 346.6571 | 546.5289 | 824.6290      | 1088.6946 | 1311.1200 (97) |
| Space heating kWh                                                              | 547.3925  | 419.0116  | 329.8506  | 149.0358 | 42.5825  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 183.4059      | 380.2564  | 561.5635 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2613.0987      |
| 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                                                              | 547.3925  | 419.0116  | 329.8506  | 149.0358 | 42.5825  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 183.4059      | 380.2564  | 561.5635 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2613.0987      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 31.7124 (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                                             | 547.3925 | 419.0116 | 329.8506 | 149.0358 | 42.5825 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 183.4059 | 380.2564 | 561.5635 (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)                              | 592.4161 | 453.4757 | 356.9812 | 161.2942 | 46.0849 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 198.4913 | 411.5329 | 607.7527 (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)   |



| 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                                        | 2828.0289          | 1.1300                              | 3195.6727 (275)            |
| Total CO2 associated with community systems                          |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                                           | 2852.4570          | 1.1300                              | 3223.2764 (278)            |
| Space and water heating                                              |                    |                                     | 6418.9491 (279)            |
| Pumps, fans and electric keep-hot                                    | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                                                  | 189.7848           | 1.5338                              | 291.0982 (282)             |
| Energy saving/generation technologies                                |                    |                                     |                            |
| PV Unit electricity used in dwelling                                 | -269.4273          | 1.4905                              | -401.5781                  |
| PV Unit electricity exported                                         | -135.8782          | 0.4582                              | -62.2555                   |
| Total                                                                |                    |                                     | -463.8335 (283)            |
| Total Primary energy kWh/year                                        |                    |                                     | 6376.3146 (286)            |
| Target Primary Energy Rate (TPER)                                    |                    |                                     | 77.3800 (287)              |