# Full SAP Calculation Printout

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|---|---|---|---|
| **Property Reference** | Flat 2 | **Issued on Date** | 22/11/2023 |
| **Assessment Reference** | 001 | **Prop Type Ref** | 118 Malden Road |
| **Property** | | | |

| | | | | | |
|---|---|---|---|---|---|
| **SAP Rating** | 86 B | **DER** | 3.96 | **TER** | 11.99 |
| **Environmental** | 97 A | **% DER < TER** | | | 66.97 |
| **$CO_2$ Emissions (t/year)** | 0.22 | **DFEE** | 30.34 | **TFEE** | 27.77 |
| **Compliance Check** | See BREL | **% DFEE < TFEE** | | | -9.24 |
| **% DPER < TPER** | 35.07 | **DPER** | 41.21 | **TPER** | 63.47 |

| | | | |
|---|---|---|---|
| **Assessor Details** | Mr. Daniel Watt | **Assessor ID** | AV75-0001 |
| **Client** | | | |

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

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1. Overall dwelling characteristics

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| | Area (m2) | | Storey height (m) | | Volume (m3) | |
|---|---|---|---|---|---|---|
| Ground floor | 66.0000 | (1b) | x 2.5000 | (2b) = | 165.0000 | (1b) - (3b) (4) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 66.0000 | | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | | 165.0000 | (5) |

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2. Ventilation rate

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| | | 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 | 0 * 10 = | 0.0000 | (7a) |
| Number of passive vents | 0 * 10 = | 0.0000 | (7b) |
| Number of flueless gas fires | 0 * 40 = | 0.0000 | (7c) |

| | Air changes per hour | | |
|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(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) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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) |

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3. Heat losses and heat loss parameter

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| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K | |
|---|---|---|---|---|---|---|---|---|
| Front (Uw = 1.20) | | | 27.3100 | 1.1450 | 31.2710 | | | (27) |
| External Walls | 57.5000 | 27.3100 | 30.1900 | 0.1800 | 5.4342 | 70.0000 | 2113.3000 | (29a) |
| Total net area of external elements Aum(A, m2) | | | 57.5000 | | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | (26)...(30) + (32) = | | 36.7052 | | | (33) |
| Party Floor 1 | | | 66.0000 | | | 40.0000 | 2640.0000 | (32d) |
| Party Ceiling 1 | | | 66.0000 | | | 30.0000 | 1980.0000 | (32b) |

| | | |
|---|---|---|
| Heat capacity Cm = Sum(A x k) | (28)...(30) + (32) + (32a)...(32e) = | 6733.3000 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | 102.0197 (35) |

List of Thermal Bridges

| | Length | Psi-value | Total |
|---|---|---|---|
| K1 Element | | | |
| E2 Other lintels (including other steel lintels) | 12.4000 | 0.0300 | 0.3720 |
| E3 Sill | 4.4000 | 0.0400 | 0.1760 |
| E4 Jamb | 27.2000 | 0.0500 | 1.3600 |
| E18 Party wall between dwellings | 5.0000 | 0.0600 | 0.3000 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E7 Party floor between dwellings (in blocks of flats) | | | | | | | | | 46.0000 | 0.0700 | 3.2200 | | |
| E16 Corner (normal) | | | | | | | | | 5.0000 | 0.0900 | 0.4500 | | |
| P1 Party wall - Ground floor | | | | | | | | | 9.8000 | 0.0320 | 0.3136 | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | | | | | | 6.1916 | (36) |
| Point Thermal bridges | | | | | | | | | | | (36a) = | 0.0000 | |
| Total fabric heat loss | | | | | | | | | | | (33) + (36) + (36a) = | 42.8968 | (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 | 14.2693 | 14.0957 | 13.9222 | 13.0544 | 12.8808 | 12.0130 | 12.0130 | 11.8395 | 12.3601 | 12.8808 | 13.2279 | 13.5751 | (38) |
| Heat transfer coeff | 57.1661 | 56.9925 | 56.8190 | 55.9512 | 55.7776 | 54.9098 | 54.9098 | 54.7363 | 55.2569 | 55.7776 | 56.1247 | 56.4719 | (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 55.9078 | |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.8662 | 0.8635 | 0.8609 | 0.8477 | 0.8451 | 0.8320 | 0.8320 | 0.8293 | 0.8372 | 0.8451 | 0.8504 | 0.8556 | (40) |
| HLP (average) | | | | | | | | | | | | 0.8471 | |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assumed occupancy | | | | | | | | | | | | 2.1452 | (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 | | | | | | | | | | | | | |
| | 69.3767 | 68.3463 | 66.8954 | 64.2201 | 62.2169 | 59.9957 | 58.7959 | 60.2367 | 61.8054 | 64.1822 | 66.9126 | 69.1421 | (42b) |
| Hot water usage for other uses | | | | | | | | | | | | | |
| | 36.5995 | 35.2686 | 33.9377 | 32.6068 | 31.2759 | 29.9450 | 29.9450 | 31.2759 | 32.6068 | 33.9377 | 35.2686 | 36.5995 | (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.5953 | (43) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily hot water use | | | | | | | | | | | | | |
| | 105.9761 | 103.6149 | 100.8331 | 96.8269 | 93.4928 | 89.9407 | 88.7409 | 91.5126 | 94.4122 | 98.1199 | 102.1811 | 105.7416 | (44) |
| Energy conte | 167.8403 | 147.5462 | 154.9767 | 132.5512 | 125.8593 | 110.5926 | 107.3244 | 113.3117 | 116.4197 | 133.1478 | 145.5758 | 165.5658 | (45) |
| Energy content (annual) | | | | | | | | | | | Total = Sum(45)m = | 1620.7112 | |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | | |
| | 25.1760 | 22.1319 | 23.2465 | 19.8827 | 18.8789 | 16.5889 | 16.0987 | 16.9967 | 17.4630 | 19.9722 | 21.8364 | 24.8349 | (46) |
| Water storage loss: | | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 173.0000 | (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.9200 | (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 | (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.0368 | (55) |
| Total storage loss | | | | | | | | | | | | | |
| | 32.1408 | 29.0304 | 32.1408 | 31.1040 | 32.1408 | 31.1040 | 32.1408 | 32.1408 | 31.1040 | 32.1408 | 31.1040 | 32.1408 | (56) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | | |
| | 32.1408 | 29.0304 | 32.1408 | 31.1040 | 32.1408 | 31.1040 | 32.1408 | 32.1408 | 31.1040 | 32.1408 | 31.1040 | 32.1408 | (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (61) |
| Total heat required for water heating calculated for each month | | | | | | | | | | | | | |
| | 199.9811 | 176.5766 | 187.1175 | 163.6552 | 158.0001 | 141.6966 | 139.4652 | 145.4525 | 147.5237 | 165.2886 | 176.6798 | 197.7066 | (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 | | | | | | | | | | | | | |
| | 199.9811 | 176.5766 | 187.1175 | 163.6552 | 158.0001 | 141.6966 | 139.4652 | 145.4525 | 147.5237 | 165.2886 | 176.6798 | 197.7066 | (64) |
| | | | | | | | | | | | Total per year (kWh/year) = Sum(64)m = | 1999.1432 | (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | 1999 | (64) |
| Electric shower(s) | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (64a) |
| | | | | | | | | | | | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | 0.0000 | (64a) |
| Heat gains from water heating, kWh/month | | | | | | | | | | | | | |
| | 55.8069 | 49.0591 | 51.5297 | 44.0733 | 41.8482 | 36.7720 | 35.6854 | 37.6761 | 38.7095 | 44.2716 | 48.4039 | 55.0506 | (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 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| | 94.7172 | 104.8655 | 94.7172 | 97.8745 | 94.7172 | 97.8745 | 94.7172 | 94.7172 | 97.8745 | 94.7172 | 97.8745 | 94.7172 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| | 187.7875 | 189.7362 | 184.8256 | 174.3717 | 161.1755 | 148.7729 | 140.4872 | 138.5386 | 143.4491 | 153.9031 | 167.0993 | 179.5018 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | (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) | | | | | | | | | | | | | |
| | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| | 75.0093 | 73.0046 | 69.2604 | 61.2129 | 56.2476 | 51.0723 | 47.9642 | 50.6400 | 53.7633 | 59.5049 | 67.2277 | 73.9928 | (72) |
| Total internal gains | | | | | | | | | | | | | |
| | 412.6927 | 422.7850 | 403.9820 | 388.6378 | 367.3190 | 352.8983 | 338.3474 | 339.0745 | 350.2655 | 363.3039 | 387.3801 | 403.3905 | (73) |

## 6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | g Specific data or Table 6b | FF Specific data or Table 6c | Access factor Table 6d | Gains W | |
|---|---|---|---|---|---|---|---|
| North | 3.6400 | 10.6334 | 0.7200 | 0.7000 | 0.7700 | 13.5188 | (74) |
| East | 11.1700 | 19.6403 | 0.7200 | 0.7000 | 0.7700 | 76.6239 | (76) |
| South | 12.5000 | 46.7521 | 0.7200 | 0.7000 | 0.7700 | 204.1148 | (78) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar gains | 294.2575 | 510.0152 | 716.5748 | 911.8058 | 1037.7218 | 1035.9934 | 996.5113 | 902.6472 | 784.7033 | 569.1739 | 354.1638 | 250.6557 | (83) |
| Total gains | 706.9502 | 932.8002 | 1120.5568 | 1300.4435 | 1405.0408 | 1388.8918 | 1334.8586 | 1241.7217 | 1134.9689 | 932.4778 | 741.5440 | 654.0462 | (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 | 32.7180 | 32.8176 | 32.9179 | 33.4284 | 33.5325 | 34.0624 | 34.0624 | 34.1704 | 33.8484 | 33.5325 | 33.3251 | 33.1202 | |
| alpha | 3.1812 | 3.1878 | 3.1945 | 3.2286 | 3.2355 | 3.2708 | 3.2708 | 3.2780 | 3.2566 | 3.2355 | 3.2217 | 3.2080 | |
| util living area | | | | | | | | | | | | | |
| | 0.8605 | 0.7549 | 0.6347 | 0.4882 | 0.3598 | 0.2509 | 0.1804 | 0.2019 | 0.3295 | 0.5637 | 0.7821 | 0.8809 | (86) |
| MIT | 19.8289 | 20.2778 | 20.6183 | 20.8566 | 20.9550 | 20.9899 | 20.9975 | 20.9963 | 20.9750 | 20.8143 | 20.3191 | 19.7352 | (87) |
| Th 2 | 20.1964 | 20.1986 | 20.2009 | 20.2121 | 20.2144 | 20.2257 | 20.2257 | 20.2280 | 20.2212 | 20.2144 | 20.2099 | 20.2054 | (88) |
| util rest of house | | | | | | | | | | | | | |
| | 0.8463 | 0.7349 | 0.6101 | 0.4610 | 0.3312 | 0.2211 | 0.1489 | 0.1683 | 0.2939 | 0.5300 | 0.7601 | 0.8683 | (89) |
| MIT 2 | 18.8495 | 19.3892 | 19.7887 | 20.0664 | 20.1729 | 20.2180 | 20.2242 | 20.2257 | 20.2009 | 20.0303 | 19.4587 | 18.7421 | (90) |
| Living area fraction | | | | | | | | | | fLA = Living area / (4) = | | 0.5576 | (91) |
| MIT | 19.3956 | 19.8846 | 20.2513 | 20.5070 | 20.6089 | 20.6484 | 20.6554 | 20.6554 | 20.6325 | 20.4674 | 19.9384 | 19.2958 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 19.3956 | 19.8846 | 20.2513 | 20.5070 | 20.6089 | 20.6484 | 20.6554 | 20.6554 | 20.6325 | 20.4674 | 19.9384 | 19.2958 | (93) |

## 8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.8305 | 0.7266 | 0.6117 | 0.4713 | 0.3457 | 0.2374 | 0.1664 | 0.1869 | 0.3128 | 0.5410 | 0.7521 | 0.8520 | (94) |
| Useful gains | 587.1234 | 677.7903 | 685.4491 | 612.9417 | 485.6581 | 329.7660 | 222.1492 | 232.1392 | 355.0170 | 504.5048 | 557.6832 | 557.2319 | (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 | | | | | | | | | | | | | |
| | 862.9565 | 854.0121 | 781.3320 | 649.4255 | 496.9191 | 332.1164 | 222.6798 | 232.9242 | 360.9647 | 550.3819 | 720.5541 | 852.4904 | (97) |
| Space heating kWh | | | | | | | | | | | | | |
| | 205.2199 | 118.4210 | 71.3369 | 26.2683 | 8.3782 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 34.1326 | 117.2671 | 219.6723 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 800.6962 | |
| 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 | | | | | | | | | | | | | |
| | 205.2199 | 118.4210 | 71.3369 | 26.2683 | 8.3782 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 34.1326 | 117.2671 | 219.6723 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 800.6962 | |
| Space heating per m2 | | | | | | | | | | | (98c) / (4) = | 12.1318 | (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) |
| Fraction of main heating from main system 2 | | | | | | | | | | | | 0.0000 | (203) |
| Fraction of total heating from main system 1 | | | | | | | | | | | | 1.0000 | (204) |
| Fraction of total heating from main system 2 | | | | | | | | | | | | 0.0000 | (205) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | 100.0000 | (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 | | | | | | | | | | | | | |
| | 205.2199 | 118.4210 | 71.3369 | 26.2683 | 8.3782 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 34.1326 | 117.2671 | 219.6723 | (98) |
| Space heating efficiency (main heating system 1) | | | | | | | | | | | | | |
| | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 100.0000 | 100.0000 | 100.0000 | (210) |
| Space heating fuel (main heating system) | | | | | | | | | | | | | |
| | 205.2199 | 118.4210 | 71.3369 | 26.2683 | 8.3782 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 34.1326 | 117.2671 | 219.6723 | (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) |
| Space heating fuel used, main system 2 | | | | | | | | | | | | 0.0000 | (213) |
| Water heating | | | | | | | | | | | | | |
| Water heating requirement | | | | | | | | | | | | | |
| | 199.9811 | 176.5766 | 187.1175 | 163.6552 | 158.0001 | 141.6966 | 139.4652 | 145.4525 | 147.5237 | 165.2886 | 176.6798 | 197.7066 | (64) |
| Efficiency of water heater | | | | | | | | | | | | 302.9550 | (216) |
| (217)m | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | 302.9550 | (217) |
| Fuel for water heating, kWh/month | | | | | | | | | | | | | |
| | 66.0102 | 58.2848 | 61.7641 | 54.0196 | 52.1530 | 46.7715 | 46.0350 | 48.0112 | 48.6949 | 54.5588 | 58.3188 | 65.2594 | (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 | 10.0443 | 9.0723 | 10.0443 | 9.7203 | 10.0443 | 9.7203 | 10.0443 | 10.0443 | 9.7203 | 10.0443 | 9.7203 | 10.0443 | (231) |
| Lighting | 21.7170 | 17.4222 | 15.6867 | 11.4928 | 8.8773 | 7.2529 | 8.0982 | 10.5264 | 13.6727 | 17.9393 | 20.2624 | 22.3205 | (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 | | | | | | | | | | | | 800.6962 | (211) |
| Space heating fuel - main system 2 | | | | | | | | | | | | 0.0000 | (213) |
| Space heating fuel - secondary | | | | | | | | | | | | 0.0000 | (215) |
| Efficiency of water heater | | | | | | | | | | | | 302.9550 | |
| Water heating fuel used | | | | | | | | | | | | 659.8813 | (219) |
| Space cooling fuel | | | | | | | | | | | | 0.0000 | (221) |
| Electricity for pumps and fans: | | | | | | | | | | | | | |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5875) | | | | | | | | | | | | | |
| mechanical ventilation fans (SFP = 0.5875) | | | | | | | | | | | | 118.2637 | (230a) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | 118.2637 | (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | 175.2683 | (232) |

| | | |
|---|---|---|
| Energy saving/generation technologies (Appendices M ,N and Q) | | |
| PV generation | 0.0000 | (233) |
| Wind generation | 0.0000 | (234) |
| Hydro-electric generation (Appendix N) | 0.0000 | (235a) |
| Electricity generated - Micro CHP (Appendix N) | 0.0000 | (235) |
| Appendix Q - special features | | |
| Energy saved or generated | -0.0000 | (236) |
| Energy used | 0.0000 | (237) |
| Total delivered energy for all uses | 1754.1096 | (238) |

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

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|
| Space heating - main system 1 | 800.6962 | 0.1578 | 126.3310 | (261) |
| Space heating - main system 2 | 0.0000 | 0.0000 | 0.0000 | (262) |
| Total CO2 associated with community systems | | | 0.0000 | (373) |
| Water heating (other fuel) | 659.8813 | 0.1410 | 93.0480 | (264) |
| Space and water heating | | | 219.3790 | (265) |
| Pumps, fans and electric keep-hot | 118.2637 | 0.1387 | 16.4046 | (267) |
| Energy for lighting | 175.2683 | 0.1443 | 25.2966 | (268) |
| Total CO2, kg/year | | | 261.0803 | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) | | | 3.9600 | (273) |

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

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year | |
|---|---|---|---|---|
| Space heating - main system 1 | 800.6962 | 1.5840 | 1268.3039 | (275) |
| Space heating - main system 2 | 0.0000 | 0.0000 | 0.0000 | (276) |
| Total CO2 associated with community systems | | | 0.0000 | (473) |
| Water heating (other fuel) | 659.8813 | 1.5214 | 1003.9426 | (278) |
| Space and water heating | | | 2272.2465 | (279) |
| Pumps, fans and electric keep-hot | 118.2637 | 1.5128 | 178.9094 | (281) |
| Energy for lighting | 175.2683 | 1.5338 | 268.8324 | (282) |
| Total Primary energy kWh/year | | | 2719.9883 | (286) |
| Dwelling Primary energy Rate (DPER) | | | 41.2100 | (287) |

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

1. Overall dwelling characteristics

| | Area (m2) | | Storey height (m) | | Volume (m3) | |
|---|---|---|---|---|---|---|
| Ground floor | 66.0000 (1b) | x | 2.5000 (2b) | = | 165.0000 | (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 66.0000 | | | | | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = | 165.0000 | (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) |
| | Air changes per hour | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 20.0000 / (5) = | 0.1212 | (8) |
| Pressure test | | Yes | |
| Pressure Test Method | | Blower Door | |
| Measured/design AP50 | | 5.0000 | (17) |
| Infiltration rate | | 0.3712 | (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) = | 0.3155 | (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 | 0.4023 | 0.3944 | 0.3865 | 0.3471 | 0.3392 | 0.2998 | 0.2998 | 0.2919 | 0.3155 | 0.3392 | 0.3550 | 0.3707 | (22b) |
| Effective ac | 0.5809 | 0.5778 | 0.5747 | 0.5602 | 0.5575 | 0.5449 | 0.5449 | 0.5426 | 0.5498 | 0.5575 | 0.5630 | 0.5687 | (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|---|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| TER Opening Type (Uw = 1.20) | | | 16.5000 | 1.1450 | 18.8931 | (27) |
| External Walls | 57.5000 | 16.5000 | 41.0000 | 0.1800 | 7.3800 | (29a) |
| Total net area of external elements Aum(A, m2) | | | 57.5000 | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | (26)...(30) + (32) = | | 26.2731 | (33) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 112.0197 (35)

List of Thermal Bridges

| K1 Element | Length | Psi-value | Total |
|---|---|---|---|
| E2 Other lintels (including other steel lintels) | 12.4000 | 0.0500 | 0.6200 |
| E3 Sill | 4.4000 | 0.0500 | 0.2200 |
| E4 Jamb | 27.2000 | 0.0500 | 1.3600 |
| E18 Party wall between dwellings | 5.0000 | 0.0600 | 0.3000 |
| E7 Party floor between dwellings (in blocks of flats) | 46.0000 | 0.0700 | 3.2200 |
| E16 Corner (normal) | 5.0000 | 0.0900 | 0.4500 |
| P1 Party wall - Ground floor | 9.8000 | 0.0800 | 0.7840 |

| | | | |
|---|---|---|---|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | 6.9540 (36) |
| Point Thermal bridges | | (36a) = | 0.0000 |
| Total fabric heat loss | (33) + (36) + (36a) = | | 33.2271 (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 | 31.6313 | 31.4602 | 31.2924 | 30.5047 | 30.3573 | 29.6712 | 29.6712 | 29.5442 | 29.9355 | 30.3573 | 30.6555 | 30.9672 | (38) |
| Heat transfer coeff | 64.8584 | 64.6873 | 64.5196 | 63.7318 | 63.5845 | 62.8984 | 62.8984 | 62.7713 | 63.1626 | 63.5845 | 63.8826 | 64.1943 | (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 63.7311 | |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.9827 | 0.9801 | 0.9776 | 0.9656 | 0.9634 | 0.9530 | 0.9530 | 0.9511 | 0.9570 | 0.9634 | 0.9679 | 0.9726 | (40) |
| HLP (average) | | | | | | | | | | | | 0.9656 | |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

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

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assumed occupancy | | | | | | | | | | | | 2.1452 | (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 | 69.3767 | 68.3463 | 66.8954 | 64.2201 | 62.2169 | 59.9957 | 58.7959 | 60.2367 | 61.8054 | 64.1822 | 66.9126 | 69.1421 | (42b) |
| Hot water usage for other uses | 36.5995 | 35.2686 | 33.9377 | 32.6068 | 31.2759 | 29.9450 | 29.9450 | 31.2759 | 32.6068 | 33.9377 | 35.2686 | 36.5995 | (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 97.5953 | (43) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily hot water use | 105.9761 | 103.6149 | 100.8331 | 96.8269 | 93.4928 | 89.9407 | 88.7409 | 91.5126 | 94.4122 | 98.1199 | 102.1811 | 105.7416 | (44) |
| Energy conte | 167.8403 | 147.5462 | 154.9767 | 132.5512 | 125.8593 | 110.5926 | 107.3244 | 113.3117 | 116.4197 | 133.1478 | 145.5758 | 165.5658 | (45) |
| Energy content (annual) | | | | | | | | | | | Total = Sum(45)m = | 1620.7112 | |
| Distribution loss (46)m = 0.15 x (45)m | 25.1760 | 22.1319 | 23.2465 | 19.8827 | 18.8789 | 16.5889 | 16.0987 | 16.9967 | 17.4630 | 19.9722 | 21.8364 | 24.8349 | (46) |
| Water storage loss: | | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 150.0000 | (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.3938 | (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 | (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.7527 | (55) |
| Total storage loss | 23.3325 | 21.0745 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | (56) |
| If cylinder contains dedicated solar storage | 23.3325 | 21.0745 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | 23.3325 | 22.5798 | 23.3325 | 22.5798 | 23.3325 | (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | (59) |
| Combi loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (61) |
| Total heat required for water heating calculated for each month | 214.4352 | 189.6319 | 201.5716 | 177.6430 | 172.4542 | 155.6844 | 153.9193 | 159.9066 | 161.5115 | 179.7427 | 190.6676 | 212.1607 | (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 | 214.4352 | 189.6319 | 201.5716 | 177.6430 | 172.4542 | 155.6844 | 153.9193 | 159.9066 | 161.5115 | 179.7427 | 190.6676 | 212.1607 | (64) |
| | | | | | | | | | Total per year (kWh/year) = Sum(64)m = | | | 2169.3287 | (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | 2169 | (64) |
| Electric shower(s) | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (64a) |
| | | | | | | | | | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | | | 0.0000 | (64a) |
| Heat gains from water heating, kWh/month | 93.0828 | 82.7277 | 88.8057 | 80.1467 | 79.1241 | 72.8455 | 72.9613 | 74.9521 | 74.7830 | 81.5476 | 84.4774 | 92.3265 | (65) |

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

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Metabolic gains (Table 5), Watts

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (66)m | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | 107.2623 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 94.7172 | 104.8655 | 94.7172 | 97.8745 | 94.7172 | 97.8745 | 94.7172 | 94.7172 | 97.8745 | 94.7172 | 97.8745 | 94.7172 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 187.7875 | 189.7362 | 184.8256 | 174.3717 | 161.1755 | 148.7729 | 140.4872 | 138.5386 | 143.4491 | 153.9031 | 167.0993 | 179.5018 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | 33.7262 | (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 3.0000 | 3.0000 | 3.0000 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | -85.8098 | (71) |
| Water heating gains (Table 5) | 125.1113 | 123.1067 | 119.3624 | 111.3149 | 106.3496 | 101.1743 | 98.0662 | 100.7420 | 103.8653 | 109.6069 | 117.3297 | 124.0948 | (72) |
| Total internal gains | 465.7947 | 475.8870 | 457.0840 | 441.7398 | 420.4211 | 403.0004 | 388.4494 | 389.1765 | 400.3676 | 416.4059 | 440.4822 | 456.4926 | (73) |

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## 6. Solar gains

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| [Jan] | Area m2 | Solar flux Table 6a W/m2 | g Specific data or Table 6b | FF Specific data or Table 6c | Access factor Table 6d | Gains W |
|---|---|---|---|---|---|---|

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | | | | 2.2000 | 10.6334 | 0.6300 | 0.7000 | 0.7700 | | | | 7.1493 | (74) |
| East | | | | 6.7500 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | | | | 40.5157 | (76) |
| South | | | | 7.5500 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | | | | 107.8747 | (78) |
| Solar gains | 155.5397 | 269.5909 | 378.7892 | 482.0074 | 548.5836 | 547.6752 | 526.8009 | 477.1712 | 414.8086 | 300.8653 | 187.2062 | 132.4918 | (83) |
| Total gains | 621.3344 | 745.4780 | 835.8732 | 923.7472 | 969.0047 | 950.6756 | 915.2503 | 866.3477 | 815.1762 | 717.2712 | 627.6884 | 588.9844 | (84) |

## 7. Mean internal temperature (heating season)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | 21.0000 | (85) |
| Utilisation factor for gains for living area, ni1,m (see Table 9a) | | | | | | | | | | | | | |
| tau | 31.6643 | 31.7480 | 31.8306 | 32.2240 | 32.2987 | 32.6510 | 32.6510 | 32.7171 | 32.5144 | 32.2987 | 32.1479 | 31.9918 | |
| alpha | 3.1110 | 3.1165 | 3.1220 | 3.1483 | 3.1532 | 3.1767 | 3.1767 | 3.1811 | 3.1676 | 3.1532 | 3.1432 | 3.1328 | |
| util living area | 0.9158 | 0.8659 | 0.7982 | 0.6866 | 0.5527 | 0.4071 | 0.2976 | 0.3265 | 0.4977 | 0.7275 | 0.8708 | 0.9257 | (86) |
| MIT | 19.4339 | 19.7928 | 20.1813 | 20.5806 | 20.8291 | 20.9521 | 20.9866 | 20.9818 | 20.9074 | 20.5724 | 19.9548 | 19.3701 | (87) |
| Th 2 | 20.0978 | 20.0999 | 20.1021 | 20.1121 | 20.1139 | 20.1227 | 20.1227 | 20.1243 | 20.1193 | 20.1139 | 20.1102 | 20.1062 | (88) |
| util rest of house | 0.9048 | 0.8499 | 0.7755 | 0.6544 | 0.5106 | 0.3558 | 0.2401 | 0.2668 | 0.4432 | 0.6912 | 0.8527 | 0.9158 | (89) |
| MIT 2 | 18.2903 | 18.7321 | 19.2040 | 19.6795 | 19.9557 | 20.0866 | 20.1153 | 20.1138 | 20.0448 | 19.6843 | 18.9477 | 18.2170 | (90) |
| Living area fraction | | | | | | | | | | fLA = Living area / (4) = | | 0.5576 | (91) |
| MIT | 18.9279 | 19.3235 | 19.7489 | 20.1819 | 20.4427 | 20.5692 | 20.6011 | 20.5978 | 20.5258 | 20.1795 | 19.5092 | 18.8599 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 18.9279 | 19.3235 | 19.7489 | 20.1819 | 20.4427 | 20.5692 | 20.6011 | 20.5978 | 20.5258 | 20.1795 | 19.5092 | 18.8599 | (93) |

## 8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.8878 | 0.8344 | 0.7658 | 0.6571 | 0.5266 | 0.3822 | 0.2717 | 0.2993 | 0.4689 | 0.6940 | 0.8387 | 0.8993 | (94) |
| Useful gains | 551.6367 | 621.9919 | 640.1270 | 606.9852 | 510.2678 | 363.3267 | 248.6318 | 259.3136 | 382.1971 | 497.7913 | 526.4696 | 529.6709 | (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 | 948.7428 | 933.0201 | 854.8129 | 719.0187 | 555.8988 | 375.4515 | 251.6651 | 263.5009 | 405.8692 | 609.1072 | 792.7352 | 941.0844 | (97) |
| Space heating kWh | 295.4470 | 209.0109 | 159.7264 | 80.6642 | 33.9495 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 82.8190 | 191.7112 | 306.0917 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 1359.4198 | |
| 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 | 295.4470 | 209.0109 | 159.7264 | 80.6642 | 33.9495 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 82.8190 | 191.7112 | 306.0917 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 1359.4198 | |
| Space heating per m2 | | | | | | | | | | | (98c) / (4) = | 20.5973 | (99) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | 0.0000 | (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | 1.0000 | (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | 92.3000 | (206) |
| Efficiency of main space heating system 2 (in %) | | | | | | | | | | | | 0.0000 | (207) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | 0.0000 | (208) |
| Space heating requirement | 295.4470 | 209.0109 | 159.7264 | 80.6642 | 33.9495 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 82.8190 | 191.7112 | 306.0917 | (98) |
| Space heating efficiency (main heating system 1) | 92.3000 | 92.3000 | 92.3000 | 92.3000 | 92.3000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 92.3000 | 92.3000 | 92.3000 | (210) |
| Space heating fuel (main heating system) | 320.0942 | 226.4473 | 173.0513 | 87.3934 | 36.7817 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 89.7281 | 207.7045 | 331.6269 | (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 | 214.4352 | 189.6319 | 201.5716 | 177.6430 | 172.4542 | 155.6844 | 153.9193 | 159.9066 | 161.5115 | 179.7427 | 190.6676 | 212.1607 | (64) |
| Efficiency of water heater | | | | | | | | | | | | 79.8000 | (216) |
| (217)m | 84.7788 | 84.2785 | 83.5433 | 82.4082 | 81.1528 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 82.4354 | 84.0720 | 84.8810 | (217) |
| Fuel for water heating, kWh/month | 252.9348 | 225.0063 | 241.2780 | 215.5647 | 212.5054 | 195.0932 | 192.8813 | 200.3842 | 202.3954 | 218.0407 | 226.7908 | 249.9507 | (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 | 19.6804 | 15.7883 | 14.2156 | 10.4150 | 8.0448 | 6.5727 | 7.3388 | 9.5392 | 12.3905 | 16.2570 | 18.3622 | 20.2273 | (232) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | |
| (233a)m | -17.7242 | -26.2820 | -39.7149 | -47.0244 | -52.7994 | -50.0575 | -49.4528 | -45.6469 | -39.2998 | -31.0894 | -19.9419 | -15.1768 | (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 | -6.4351 | -13.8303 | -28.0405 | -42.9341 | -57.5748 | -58.1385 | -57.4489 | -48.2675 | -34.8939 | -20.0388 | -8.6750 | -5.0667 | (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 | | | | | | | | | | | | 1472.8275 | (211) |
| Space heating fuel - main system 2 | | | | | | | | | | | | 0.0000 | (213) |
| Space heating fuel - secondary | | | | | | | | | | | | 0.0000 | (215) |
| Efficiency of water heater | | | | | | | | | | | | 79.8000 | |
| Water heating fuel used | | | | | | | | | | | | 2632.8256 | (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) | 158.8319 | (232) |
| | | |
| Energy saving/generation technologies (Appendices M ,N and Q) | | |
| PV generation | -815.5538 | (233) |
| Wind generation | 0.0000 | (234) |
| Hydro-electric generation (Appendix N) | 0.0000 | (235a) |
| Electricity generated - Micro CHP (Appendix N) | 0.0000 | (235) |
| Appendix Q - special features | | |
| Energy saved or generated | -0.0000 | (236) |
| Energy used | 0.0000 | (237) |
| Total delivered energy for all uses | 3534.9311 | (238) |

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

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|
| Space heating - main system 1 | 1472.8275 | 0.2100 | 309.2938 | (261) |
| Total CO2 associated with community systems | | | 0.0000 | (373) |
| Water heating (other fuel) | 2632.8256 | 0.2100 | 552.8934 | (264) |
| Space and water heating | | | 862.1871 | (265) |
| Pumps, fans and electric keep-hot | 86.0000 | 0.1387 | 11.9293 | (267) |
| Energy for lighting | 158.8319 | 0.1443 | 22.9243 | (268) |
| | | | | |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -434.2099 | 0.1335 | -57.9809 | |
| PV Unit electricity exported | -381.3440 | 0.1253 | -47.7969 | |
| Total | | | -105.7779 | (269) |
| Total CO2, kg/year | | | 791.2629 | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) | | | 11.9900 | (273) |

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

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year | |
|---|---|---|---|---|
| Space heating - main system 1 | 1472.8275 | 1.1300 | 1664.2951 | (275) |
| Total CO2 associated with community systems | | | 0.0000 | (473) |
| Water heating (other fuel) | 2632.8256 | 1.1300 | 2975.0929 | (278) |
| Space and water heating | | | 4639.3880 | (279) |
| Pumps, fans and electric keep-hot | 86.0000 | 1.5128 | 130.1008 | (281) |
| Energy for lighting | 158.8319 | 1.5338 | 243.6216 | (282) |
| | | | | |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -434.2099 | 1.4935 | -648.4715 | |
| PV Unit electricity exported | -381.3440 | 0.4601 | -175.4375 | |
| Total | | | -823.9090 | (283) |
| Total Primary energy kWh/year | | | 4189.2014 | (286) |
| Target Primary Energy Rate (TPER) | | | 63.4700 | (287) |