# Full SAP Calculation Printout

| | | | |
|---|---|---|---|
| **Property Reference** | Flat 02_04 mid N | **Issued on Date** | 25/01/2024 |
| **Assessment Reference** | Flat 02_04 mid N BE GREEN | **Prop Type Ref** | SE_01_009 exposed floor W |
| **Property** | | | |

| | | | | | |
|---|---|---|---|---|---|
| **SAP Rating** | 85 B | **DER** | 2.63 | **TER** | 11.38 |
| **Environmental** | 98 A | **% DER < TER** | | | 76.89 |
| **$CO_2$ Emissions (t/year)** | 0.21 | **DFEE** | 26.06 | **TFEE** | 26.20 |
| **Compliance Check** | See BREL | **% DFEE < TFEE** | | | 0.55 |
| **% DPER < TPER** | 55.19 | **DPER** | 27.64 | **TPER** | 61.69 |

| | | | |
|---|---|---|---|
| **Assessor Details** | Miss Amy Webb | **Assessor ID** | V831-0001 |
| **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 | 86.4700 | (1b) | x 2.5300 | (2b) = | 218.7691 | (1b) - (3b) (4) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 86.4700 | | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | | 218.7691 | (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 | | | 3 | (19) |
| Shelter factor | | (20) = 1 - [0.075 x (19)] = | 0.7750 | (20) |
| Infiltration rate adjusted to include shelter factor | | (21) = (18) x (20) = | 0.1162 | (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 | 0.1482 | 0.1453 | 0.1424 | 0.1279 | 0.1250 | 0.1104 | 0.1104 | 0.1075 | 0.1162 | 0.1250 | 0.1308 | 0.1366 | (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) = | 73.6000 | (23c) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Effective ac | 0.2802 | 0.2773 | 0.2744 | 0.2599 | 0.2570 | 0.2424 | 0.2424 | 0.2395 | 0.2482 | 0.2570 | 0.2628 | 0.2686 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Window (Uw = 1.20) | | | 16.9700 | 1.1450 | 19.4313 | | | (27) |
| Int door | | | 1.7000 | 1.1000 | 1.8700 | | | (26) |
| External Wall 1 | 65.3800 | 18.6700 | 46.7100 | 0.1500 | 7.0065 | 14.0000 | 653.9400 | (29a) |
| stair wall | 28.4100 | | 28.4100 | 0.1800 | 5.1138 | 14.0000 | 397.7400 | (29a) |
| Total net area of external elements Aum(A, m2) | | | 93.7900 | | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | (26)...(30) + (32) = | | 33.4216 | | | (33) |
| Party Wall 1 | | | 23.0600 | 0.0000 | 0.0000 | 20.0000 | 461.2000 | (32) |
| Party Floor 1 | | | 86.4700 | | | 40.0000 | 3458.8000 | (32d) |
| Party Ceiling 1 | | | 86.4700 | | | 90.0000 | 7782.3000 | (32b) |
| Internal Wall 1 | | | 186.9700 | | | 9.0000 | 1682.7300 | (32c) |

| | | |
|---|---|---|
| Heat capacity Cm = Sum(A x k) | (28)...(30) + (32) + (32a)...(32e) = 14436.7100 | (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | 166.9563 | (35) |

List of Thermal Bridges

| K1 Element | Length | Psi-value | Total |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| E7 Party floor between dwellings (in blocks of flats) | 62.9300 | 0.0400 | 2.5172 | |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 18.2200 | 0.0000 | 0.0000 | |
| E16 Corner (normal) | 10.1200 | 0.0900 | 0.9108 | |
| E18 Party wall between dwellings | 5.0600 | 0.0600 | 0.3036 | |
| E17 Corner (inverted - internal area greater than external area) | 5.0600 | 0.0000 | 0.0000 | |
| E3 Sill | 7.0000 | 0.0500 | 0.3500 | |
| E9 Balcony between dwellings, wall insulation continuous | 11.2100 | 0.1000 | 1.1210 | |
| E1 Steel lintel with perforated steel base plate | 10.4400 | 0.1000 | 1.0440 | |
| E4 Jamb | 30.2000 | 0.0500 | 1.5100 | |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.7566 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 41.1782 (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 | 20.2301 | 20.0202 | 19.8104 | 18.7614 | 18.5516 | 17.5025 | 17.5025 | 17.2927 | 17.9221 | 18.5516 | 18.9712 | 19.3908 | (38) |
| Heat transfer coeff | 61.4083 | 61.1984 | 60.9886 | 59.9396 | 59.7297 | 58.6807 | 58.6807 | 58.4709 | 59.1003 | 59.7297 | 60.1494 | 60.5690 | (39) |

Average = Sum(39)m / 12 = 59.8871

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.7102 | 0.7077 | 0.7053 | 0.6932 | 0.6908 | 0.6786 | 0.6786 | 0.6762 | 0.6835 | 0.6908 | 0.6956 | 0.7005 | (40) |
| HLP (average) | | | | | | | | | | | | 0.6926 | |
| 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 2.5743 (42)

Hot water usage for mixer showers

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67.3815 | 66.3689 | 64.8934 | 62.0701 | 59.9866 | 57.6631 | 56.3425 | 57.8069 | 59.4121 | 61.9069 | 64.7907 | 67.1234 | (42a) |

Hot water usage for baths

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29.0995 | 28.6673 | 28.0587 | 26.9366 | 26.0964 | 25.1647 | 24.6615 | 25.2658 | 25.9238 | 26.9207 | 28.0660 | 29.0011 | (42b) |

Hot water usage for other uses

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.9930 | 39.5023 | 38.0116 | 36.5210 | 35.0303 | 33.5397 | 33.5397 | 35.0303 | 36.5210 | 38.0116 | 39.5023 | 40.9930 | (42c) |

Average daily hot water use (litres/day) 126.3697 (43)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily hot water use | 137.4740 | 134.5386 | 130.9637 | 125.5277 | 121.1134 | 116.3675 | 114.5436 | 118.1030 | 121.8569 | 126.8392 | 132.3590 | 137.1175 | (44) |
| Energy conte | 217.7252 | 191.5811 | 201.2864 | 171.8412 | 163.0419 | 143.0875 | 138.5306 | 146.2362 | 150.2618 | 172.1196 | 188.5697 | 214.6928 | (45) |
| Energy content (annual) | | | | | | | | | | Total = Sum(45)m = | | 2098.9739 | |
| Distribution loss (46)m = 0.15 x (45)m | 32.6588 | 28.7372 | 30.1930 | 25.7762 | 24.4563 | 21.4631 | 20.7796 | 21.9354 | 22.5393 | 25.8179 | 28.2854 | 32.2039 | (46) |

Water storage loss:

Store volume 110.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)

Enter (49) or (54) in (55) 1.0327 (55)

Total storage loss

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32.0144 | 28.9162 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 | (56) |

If cylinder contains dedicated solar storage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32.0144 | 28.9162 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 | 32.0144 | 30.9817 | 32.0144 | 30.9817 | 32.0144 | (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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 273.0020 | 241.5086 | 256.5632 | 225.3349 | 218.3187 | 196.5811 | 193.8074 | 201.5130 | 203.7555 | 227.3964 | 242.0633 | 269.9696 | (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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 273.0020 | 241.5086 | 256.5632 | 225.3349 | 218.3187 | 196.5811 | 193.8074 | 201.5130 | 203.7555 | 227.3964 | 242.0633 | 269.9696 | (64) |

Total per year (kWh/year) = Sum(64)m = 2749.8136 (64)

12Total per year (kWh/year) 2750 (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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 116.6151 | 103.6427 | 111.1492 | 99.9321 | 98.4329 | 90.3715 | 90.2829 | 92.8450 | 92.7570 | 101.4512 | 105.4944 | 115.6068 | (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 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 117.2350 | 129.7959 | 117.2350 | 121.1429 | 117.2350 | 121.1429 | 117.2350 | 117.2350 | 121.1429 | 117.2350 | 121.1429 | 117.2350 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 232.4315 | 234.8435 | 228.7655 | 215.8263 | 199.4929 | 184.1417 | 173.8862 | 171.4743 | 177.5523 | 190.4915 | 206.8249 | 222.1760 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | (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) | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | (71) |
| Water heating gains (Table 5) | 156.7407 | 154.2302 | 149.3940 | 138.7946 | 132.3022 | 125.5160 | 121.3479 | 124.7916 | 128.8291 | 136.3592 | 146.5199 | 155.3855 | (72) |
| Total internal gains | 568.0211 | 580.4834 | 557.0084 | 537.3776 | 510.6439 | 492.4144 | 474.0830 | 475.1148 | 489.1381 | 505.6995 | 536.1015 | 556.4104 | (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 | |
|---|---|---|---|---|---|---|---|
| North | 2.8000 | 10.6334 | 0.4000 | 0.8500 | 0.7700 | 7.0152 | (74) |
| South | 14.1700 | 46.7521 | 0.4000 | 0.8500 | 0.7700 | 156.0928 | (78) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar gains | 163.1080 | 269.0462 | 348.4205 | 404.6354 | 432.8168 | 421.8590 | 409.8900 | 389.3020 | 367.5591 | 291.6901 | 193.6774 | 140.7268 | (83) |
| Total gains | 731.1291 | 849.5296 | 905.4290 | 942.0131 | 943.4607 | 914.2735 | 883.9730 | 864.4168 | 856.6972 | 797.3896 | 729.7789 | 697.1371 | (84) |

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7. Mean internal temperature (heating season)

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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)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| tau | 65.3039 | 65.5278 | 65.7532 | 66.9040 | 67.1390 | 68.3393 | 68.3393 | 68.5845 | 67.8541 | 67.1390 | 66.6706 | 66.2087 | |
| alpha | 5.3536 | 5.3685 | 5.3835 | 5.4603 | 5.4759 | 5.5560 | 5.5560 | 5.5723 | 5.5236 | 5.4759 | 5.4447 | 5.4139 | |
| util living area | 0.9469 | 0.8983 | 0.8332 | 0.7178 | 0.5750 | 0.4090 | 0.2919 | 0.3108 | 0.4718 | 0.7243 | 0.8961 | 0.9554 | (86) |
| MIT | 20.3715 | 20.5806 | 20.7547 | 20.9070 | 20.9754 | 20.9970 | 20.9996 | 20.9995 | 20.9932 | 20.9173 | 20.6551 | 20.3353 | (87) |
| Th 2 | 20.3319 | 20.3340 | 20.3361 | 20.3469 | 20.3490 | 20.3598 | 20.3598 | 20.3619 | 20.3555 | 20.3490 | 20.3447 | 20.3404 | (88) |
| util rest of house | 0.9384 | 0.8840 | 0.8122 | 0.6881 | 0.5382 | 0.3688 | 0.2495 | 0.2679 | 0.4292 | 0.6897 | 0.8794 | 0.9481 | (89) |
| MIT 2 | 19.6096 | 19.8653 | 20.0733 | 20.2547 | 20.3276 | 20.3577 | 20.3596 | 20.3616 | 20.3505 | 20.2704 | 19.9682 | 19.5719 | (90) |
| Living area fraction | | | | | | | | | | fLA = Living area / (4) = | | 0.3277 | (91) |
| MIT | 19.8593 | 20.0997 | 20.2966 | 20.4685 | 20.5399 | 20.5672 | 20.5693 | 20.5707 | 20.5611 | 20.4824 | 20.1934 | 19.8221 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 19.8593 | 20.0997 | 20.2966 | 20.4685 | 20.5399 | 20.5672 | 20.5693 | 20.5707 | 20.5611 | 20.4824 | 20.1934 | 19.8221 | (93) |

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8. Space heating requirement

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| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.9314 | 0.8786 | 0.8109 | 0.6938 | 0.5491 | 0.3818 | 0.2634 | 0.2819 | 0.4429 | 0.6971 | 0.8751 | 0.9414 | (94) |
| Useful gains | 681.0043 | 746.3697 | 734.1818 | 653.5590 | 518.0891 | 349.1140 | 232.8201 | 243.7118 | 379.4038 | 555.8255 | 638.6509 | 656.2705 | (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 | 955.4714 | 930.2008 | 841.4358 | 693.4085 | 528.0036 | 350.1601 | 232.9239 | 243.8634 | 381.8555 | 590.2734 | 787.5581 | 946.2158 | (97) |
| Space heating kWh | 204.2036 | 123.5345 | 79.7969 | 28.6917 | 7.3764 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 25.6292 | 107.2132 | 215.7193 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 792.1648 | |
| 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 | 204.2036 | 123.5345 | 79.7969 | 28.6917 | 7.3764 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 25.6292 | 107.2132 | 215.7193 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 792.1648 | |
| Space heating per m2 | | | | | | | | | | | (98c) / (4) = | 9.1612 | (99) |

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9b. Energy requirements

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | | | | | 1.2300 | (306) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | 0.0000 | (208) |
| Space heating: | | | | | | | | | | | | | |
| Space heating requirement | 204.2036 | 123.5345 | 79.7969 | 28.6917 | 7.3764 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 25.6292 | 107.2132 | 215.7193 | (98) |
| Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.23 | | | | | | | | | | | | | |
| 307a | 251.1704 | 151.9475 | 98.1502 | 35.2908 | 9.0729 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 31.5240 | 131.8722 | 265.3347 | |
| Space heating requirement | 251.1704 | 151.9475 | 98.1502 | 35.2908 | 9.0729 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 31.5240 | 131.8722 | 265.3347 | (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 | 273.0020 | 241.5086 | 256.5632 | 225.3349 | 218.3187 | 196.5811 | 193.8074 | 201.5130 | 203.7555 | 227.3964 | 242.0633 | 269.9696 | (64) |
| Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.23 | | | | | | | | | | | | | |
| 310a | 335.7925 | 297.0555 | 315.5727 | 277.1619 | 268.5320 | 241.7948 | 238.3831 | 247.8610 | 250.6192 | 279.6976 | 297.7379 | 332.0626 | |
| Water heating fuel | 335.7925 | 297.0555 | 315.5727 | 277.1619 | 268.5320 | 241.7948 | 238.3831 | 247.8610 | 250.6192 | 279.6976 | 297.7379 | 332.0626 | (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 | 17.4544 | 15.7653 | 17.4544 | 16.8914 | 17.4544 | 16.8914 | 17.4544 | 17.4544 | 16.8914 | 17.4544 | 16.8914 | 17.4544 | (331) |
| Lighting | 24.3591 | 19.5418 | 17.5952 | 12.8910 | 9.9574 | 8.1353 | 9.0835 | 11.8070 | 15.3362 | 20.1219 | 22.7276 | 25.0361 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | |
| (333a)m | -12.8059 | -19.6827 | -30.8849 | -38.0197 | -43.9688 | -42.1705 | -41.6368 | -37.7702 | -31.5482 | -23.8427 | -14.6379 | -10.8871 | (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 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (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 | | | | | | | | | | | | 974.3627 | (307) |
| Space heating fuel - secondary | | | | | | | | | | | | 0.0000 | (309) |
| Water heating fuel - community heating | | | | | | | | | | | | 3382.2708 | (310) |
| Efficiency of water heater | | | | | | | | | | | | 0.0000 | (311) |
| Electricity used for heat distribution | | | | | | | | | | | | 9.7436 | (313) |
| Space cooling fuel | | | | | | | | | | | | 0.0000 | (321) |
| Electricity for pumps and fans: | | | | | | | | | | | | | |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7700) | | | | | | | | | | | | | |
| mechanical ventilation fans (SFP = 0.7700) | | | | | | | | | | | | 205.5117 | (330a) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | 205.5117 | (331) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | 196.5921 | (332) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| PV generation | | | | | | | | | | | | -347.8554 | (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 | 4410.8818 | (338) |

12b. Carbon dioxide emissions - Community heating scheme

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|
| Efficiency of heat source Heat pump | | | 300.0000 | (367) |
| Space and Water heating from Heat pump | 1452.2112 | 0.1580 | 51.3210 | (367) |
| Electrical energy for heat distribution (space & water) | 9.7436 | 0.0000 | 6.3052 | (372) |
| Overall CO2 factor for heat network | | | 0.0497 | (386) |
| Total CO2 associated with community systems | | | 216.4801 | (373) |
| Space and water heating | | | 216.4801 | (376) |
| Pumps, fans and electric keep-hot | 205.5117 | 0.1387 | 28.5070 | (378) |
| Energy for lighting | 196.5921 | 0.1443 | 28.3743 | (379) |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -347.8554 | 0.1328 | -46.1915 | |
| PV Unit electricity exported | 0.0000 | 0.0000 | 0.0000 | |
| Total | | | -46.1915 | (380) |
| Total CO2, kg/year | | | 227.1699 | (383) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) | | | 2.6300 | (384) |

13b. Primary energy - Community heating scheme

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year | |
|---|---|---|---|---|
| Efficiency of heat source Heat pump | | | 300.0000 | (467a) |
| Space and Water heating from Heat pump | 1452.2112 | 1.5849 | 514.7597 | (467) |
| Electrical energy for heat distribution (space & water) | 9.7436 | 0.0000 | 66.8870 | (472) |
| Overall CO2 factor for heat network | | | 0.5271 | (486) |
| Total CO2 associated with community systems | | | 2296.4541 | (473) |
| Space and water heating | | | 2296.4541 | (476) |
| Pumps, fans and electric keep-hot | 205.5117 | 1.5128 | 310.8981 | (478) |
| Energy for lighting | 196.5921 | 1.5338 | 301.5395 | (479) |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -347.8554 | 1.4907 | -518.5353 | |
| PV Unit electricity exported | 0.0000 | 0.0000 | 0.0000 | |
| Total | | | -518.5353 | (480) |
| Total Primary energy kWh/year | | | 2390.3564 | (483) |
| Dwelling Primary energy Rate (DPER) | | | 27.6400 | (484) |

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 | 86.4700 (1b) | x | 2.5300 (2b) | = | 218.7691 | (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 86.4700 | | | | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = | 218.7691 | (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) |
| | Air changes per hour | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1371 | (8) |
| Pressure test | | Yes | |
| Pressure Test Method | | Blower Door | |
| Measured/design AP50 | | 5.0000 | (17) |
| Infiltration rate | | 0.3871 | (18) |
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.7750 | (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) = | 0.3000 | (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 | 0.3825 | 0.3750 | 0.3675 | 0.3300 | 0.3225 | 0.2850 | 0.2850 | 0.2775 | 0.3000 | 0.3225 | 0.3375 | 0.3525 | (22b) |
| Effective ac | 0.5732 | 0.5703 | 0.5675 | 0.5545 | 0.5520 | 0.5406 | 0.5406 | 0.5385 | 0.5450 | 0.5520 | 0.5570 | 0.5621 | (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 | |
|---|---|---|---|---|---|---|---|---|
| TER Opaque door | | | 1.7000 | 1.0000 | 1.7000 | | | (26) |
| TER Opening Type (Uw = 1.20) | | | 16.9700 | 1.1450 | 19.4313 | | | (27) |
| External Wall 1 | 65.3800 | 18.6700 | 46.7100 | 0.1800 | 8.4078 | | | (29a) |
| stair wall | 28.4100 | | 28.4100 | 0.1800 | 5.1138 | | | (29a) |
| Total net area of external elements Aum(A, m2) | | | 93.7900 | | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | (26)...(30) + (32) = | | 34.6529 | | | (33) |
| Party Wall 1 | | | 23.0600 | 0.0000 | 0.0000 | | | (32) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 140.9563 (35)

List of Thermal Bridges

| | K1 Element | Length | Psi-value | Total |
|---|---|---|---|---|
| | E7 Party floor between dwellings (in blocks of flats) | 62.9300 | 0.0700 | 4.4051 |
| | P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 18.2200 | 0.0000 | 0.0000 |
| | E16 Corner (normal) | 10.1200 | 0.0900 | 0.9108 |
| | E18 Party wall between dwellings | 5.0600 | 0.0600 | 0.3036 |
| | E17 Corner (inverted - internal area greater than external area) | 5.0600 | -0.0900 | -0.4554 |
| | E3 Sill | 7.0000 | 0.0500 | 0.3500 |
| | E9 Balcony between dwellings, wall insulation continuous | 11.2100 | 0.0200 | 0.2242 |
| | E1 Steel lintel with perforated steel base plate | 10.4400 | 0.0500 | 0.5220 |
| | E4 Jamb | 30.2000 | 0.0500 | 1.5100 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.7703 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 42.4232 (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 | 41.3790 | 41.1739 | 40.9729 | 40.0285 | 39.8519 | 39.0294 | 39.0294 | 38.8771 | 39.3462 | 39.8519 | 40.2093 | 40.5830 | (38) |
| Heat transfer coeff | 83.8022 | 83.5971 | 83.3961 | 82.4517 | 82.2751 | 81.4526 | 81.4526 | 81.3003 | 81.7694 | 82.2751 | 82.6325 | 83.0062 | (39) |

Average = Sum(39)m / 12 = 82.4509

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.9691 | 0.9668 | 0.9645 | 0.9535 | 0.9515 | 0.9420 | 0.9420 | 0.9402 | 0.9456 | 0.9515 | 0.9556 | 0.9599 | (40) |
| HLP (average) | | | | | | | | | | | | 0.9535 | |
| 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 2.5743 (42)

Hot water usage for mixer showers

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67.3815 | 66.3689 | 64.8934 | 62.0701 | 59.9866 | 57.6631 | 56.3425 | 57.8069 | 59.4121 | 61.9069 | 64.7907 | 67.1234 | (42a) |

Hot water usage for baths

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29.0995 | 28.6673 | 28.0587 | 26.9366 | 26.0964 | 25.1647 | 24.6615 | 25.2658 | 25.9238 | 26.9207 | 28.0660 | 29.0011 | (42b) |

Hot water usage for other uses

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.9930 | 39.5023 | 38.0116 | 36.5210 | 35.0303 | 33.5397 | 33.5397 | 35.0303 | 36.5210 | 38.0116 | 39.5023 | 40.9930 | (42c) |

Average daily hot water use (litres/day) 126.3697 (43)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily hot water use | 137.4740 | 134.5386 | 130.9637 | 125.5277 | 121.1134 | 116.3675 | 114.5436 | 118.1030 | 121.8569 | 126.8392 | 132.3590 | 137.1175 | (44) |
| Energy conte | 217.7252 | 191.5811 | 201.2864 | 171.8412 | 163.0419 | 143.0875 | 138.5306 | 146.2362 | 150.2618 | 172.1196 | 188.5697 | 214.6928 | (45) |

Energy content (annual) Total = Sum(45)m = 2098.9739

Distribution loss (46)m = 0.15 x (45)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32.6588 | 28.7372 | 30.1930 | 25.7762 | 24.4563 | 21.4631 | 20.7796 | 21.9354 | 22.5393 | 25.8179 | 28.2854 | 32.2039 | (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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 264.3201 | 233.6668 | 247.8813 | 216.9330 | 209.6368 | 188.1793 | 185.1255 | 192.8311 | 195.3536 | 218.7145 | 233.6615 | 261.2877 | (62) |
| WWHRS -30.8040 | -27.2433 | -28.5277 | -23.6220 | -22.0149 | -18.8383 | -17.6579 | -18.7774 | -19.4908 | -22.9775 | -26.0307 | -30.2336 | (63a) |
| PV diverter -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 | (63b) |
| Solar input 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (63c) |
| FGHRS 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (63d) |

Output from w/h

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 233.5161 | 206.4235 | 219.3537 | 193.3110 | 187.6219 | 169.3410 | 167.4676 | 174.0537 | 175.8628 | 195.7370 | 207.6308 | 231.0541 | (64) |

Total per year (kWh/year) = Sum(64)m = 2361.3731 (64)

12Total per year (kWh/year) 2361 (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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 109.6696 | 97.3693 | 104.2036 | 93.2107 | 91.4873 | 83.6501 | 83.3373 | 85.8995 | 86.0355 | 94.5057 | 98.7729 | 108.6613 | (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 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | 128.7128 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 118.3072 | 130.9830 | 118.3072 | 122.2508 | 118.3072 | 122.2508 | 118.3072 | 118.3072 | 122.2508 | 118.3072 | 122.2508 | 118.3072 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 232.4315 | 234.8435 | 228.7655 | 215.8263 | 199.4929 | 184.1417 | 173.8862 | 171.4743 | 177.5523 | 190.4915 | 206.8249 | 222.1760 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | 35.8713 | (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) | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | -102.9702 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 147.4053 | 144.8948 | 140.0587 | 129.4593 | 122.9669 | 116.1806 | 112.0126 | 115.4563 | 119.4938 | 127.0238 | 137.1846 | 146.0501 | (72) |
| Total internal gains | 562.7579 | 575.3351 | 551.7453 | 532.1502 | 505.3808 | 484.1870 | 465.8199 | 466.8517 | 480.9107 | 500.4364 | 530.8741 | 551.1472 | (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 | 2.8000 | 10.6334 | 0.6300 | 0.7000 | 0.7700 | 9.0992 | (74) |
| South | 14.1700 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 202.4615 | (78) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar gains | 211.5607 | 348.9688 | 451.9219 | 524.8360 | 561.3888 | 547.1760 | 531.6515 | 504.9476 | 476.7457 | 378.3392 | 251.2109 | 182.5309 | (83) |
| Total gains | 774.3186 | 924.3039 | 1003.6672 | 1056.9862 | 1066.7696 | 1031.3630 | 997.4713 | 971.7993 | 957.6564 | 878.7756 | 782.0851 | 733.6781 | (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, ni1,m (see Table 9a) | | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| tau | 40.4010 | 40.5001 | 40.5977 | 41.0627 | 41.1509 | 41.5664 | 41.5664 | 41.6443 | 41.4054 | 41.1509 | 40.9729 | 40.7884 | |
| alpha | 3.6934 | 3.7000 | 3.7065 | 3.7375 | 3.7434 | 3.7711 | 3.7711 | 3.7763 | 3.7604 | 3.7434 | 3.7315 | 3.7192 | |
| util living area | 0.9465 | 0.9059 | 0.8541 | 0.7656 | 0.6436 | 0.4856 | 0.3544 | 0.3783 | 0.5531 | 0.7785 | 0.9092 | 0.9543 | (86) |
| MIT | 19.6719 | 19.9861 | 20.2977 | 20.6228 | 20.8426 | 20.9589 | 20.9902 | 20.9873 | 20.9308 | 20.6565 | 20.1249 | 19.6129 | (87) |
| Th 2 | 20.1091 | 20.1111 | 20.1131 | 20.1222 | 20.1240 | 20.1320 | 20.1320 | 20.1335 | 20.1289 | 20.1240 | 20.1205 | 20.1168 | (88) |
| util rest of house | 0.9378 | 0.8920 | 0.8331 | 0.7336 | 0.5977 | 0.4258 | 0.2865 | 0.3097 | 0.4933 | 0.7418 | 0.8934 | 0.9468 | (89) |
| MIT 2 | 18.5787 | 18.9672 | 19.3474 | 19.7372 | 19.9813 | 20.1026 | 20.1271 | 20.1268 | 20.0759 | 19.7854 | 19.1523 | 18.5108 | (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.3277 | (91) |
| MIT | 18.9370 | 19.3011 | 19.6589 | 20.0274 | 20.2636 | 20.3833 | 20.4100 | 20.4088 | 20.3561 | 20.0709 | 19.4710 | 18.8720 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 18.9370 | 19.3011 | 19.6589 | 20.0274 | 20.2636 | 20.3833 | 20.4100 | 20.4088 | 20.3561 | 20.0709 | 19.4710 | 18.8720 | (93) |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.9238 | 0.8772 | 0.8212 | 0.7299 | 0.6053 | 0.4435 | 0.3085 | 0.3318 | 0.5094 | 0.7394 | 0.8796 | 0.9335 | (94) |
| Useful gains | 715.2975 | 810.7815 | 824.2000 | 771.4539 | 645.7080 | 457.4120 | 307.7061 | 322.3997 | 487.8104 | 649.7336 | 687.9216 | 684.9245 | (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 | 1226.6099 | 1203.8929 | 1097.3977 | 917.4759 | 704.5711 | 471.0612 | 310.3328 | 325.9179 | 511.5593 | 779.2214 | 1022.2492 | 1217.8651 | (97) |
| Space heating kWh | 380.4164 | 264.1708 | 203.2591 | 105.1358 | 43.7942 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 96.3389 | 240.7159 | 396.5078 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 1730.3390 | |
| 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 | 380.4164 | 264.1708 | 203.2591 | 105.1358 | 43.7942 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 96.3389 | 240.7159 | 396.5078 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 1730.3390 | |
| Space heating per m2 | | | | | | | | | | (98c) / (4) = | | 20.0109 | (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) |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| Space heating requirement | 380.4164 | 264.1708 | 203.2591 | 105.1358 | 43.7942 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 96.3389 | 240.7159 | 396.5078 | (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) | 412.1521 | 286.2089 | 220.2157 | 113.9066 | 47.4476 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 104.3759 | 260.7973 | 429.5859 | (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 | 233.5161 | 206.4235 | 219.3537 | 193.3110 | 187.6219 | 169.3410 | 167.4676 | 174.0537 | 175.8628 | 195.7370 | 207.6308 | 231.0541 | (64) |
| Efficiency of water heater | | | | | | | | | | | | 79.8000 | (216) |
| (217)m | 85.1474 | 84.6140 | 83.8892 | 82.7546 | 81.3605 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 82.5600 | 84.3922 | 85.2597 | (217) |
| Fuel for water heating, kWh/month | 274.2493 | 243.9589 | 261.4801 | 233.5953 | 230.6056 | 212.2068 | 209.8591 | 218.1124 | 220.3794 | 237.0846 | 246.0307 | 271.0004 | (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 | 24.5819 | 19.7205 | 17.7561 | 13.0089 | 10.0485 | 8.2097 | 9.1665 | 11.9150 | 15.4764 | 20.3059 | 22.9355 | 25.2651 | (232) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | |
| (233a)m | -9.5033 | -14.7128 | -23.1950 | -28.6828 | -33.3005 | -31.9636 | -31.5722 | -28.6011 | -23.8381 | -17.8987 | -10.9024 | -8.0701 | (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 | -2.0066 | -4.3975 | -9.0849 | -14.1751 | -19.2839 | -19.5830 | -19.3578 | -16.1415 | -11.5091 | -6.4598 | -2.7313 | -1.5743 | (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 | 1874.6901 | (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 | 2858.5627 | (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) | 198.3901 | (232) |
| | | |
| Energy saving/generation technologies (Appendices M ,N and Q) | | |
| PV generation | -388.5451 | (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 | 4629.0978 | (238) |

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

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| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|
| Space heating - main system 1 | 1874.6901 | 0.2100 | 393.6849 | (261) |
| Total CO2 associated with community systems | | | 0.0000 | (373) |
| Water heating (other fuel) | 2858.5627 | 0.2100 | 600.2982 | (264) |
| Space and water heating | | | 993.9831 | (265) |
| Pumps, fans and electric keep-hot | 86.0000 | 0.1387 | 11.9293 | (267) |
| Energy for lighting | 198.3901 | 0.1443 | 28.6338 | (268) |
| | | | | |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -262.2404 | 0.1327 | -34.7968 | |
| PV Unit electricity exported | -126.3047 | 0.1248 | -15.7621 | |
| Total | | | -50.5590 | (269) |
| Total CO2, kg/year | | | 983.9872 | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) | | | 11.3800 | (273) |

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

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| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year | |
|---|---|---|---|---|
| Space heating - main system 1 | 1874.6901 | 1.1300 | 2118.3999 | (275) |
| Total CO2 associated with community systems | | | 0.0000 | (473) |
| Water heating (other fuel) | 2858.5627 | 1.1300 | 3230.1759 | (278) |
| Space and water heating | | | 5348.5757 | (279) |
| Pumps, fans and electric keep-hot | 86.0000 | 1.5128 | 130.1008 | (281) |
| Energy for lighting | 198.3901 | 1.5338 | 304.2973 | (282) |
| | | | | |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -262.2404 | 1.4903 | -390.8149 | |
| PV Unit electricity exported | -126.3047 | 0.4580 | -57.8509 | |
| Total | | | -448.6658 | (283) |
| Total Primary energy kWh/year | | | 5334.3080 | (286) |
| Target Primary Energy Rate (TPER) | | | 61.6900 | (287) |