# Summary for Input Data

| | | | |
|---|---|---|---|
| Plot Reference | A 205 | Issued on Date | 19/03/2026 |
| Assessment Reference | Be Lean | Plot Type Ref | |
| Plot Address | | SAP Version | 10.2 |

| | | | | | |
|---|---|---|---|---|---|
| SAP Rating | 86 B | DER | 10.98 | TER | 13.17 |
| Environmental | 91 B | % DER < TER | | | 16.63 |
| $CO_2$ Emissions (t/year) | 0.85 | DFEE | 32.57 | TFEE | 34.51 |
| Compliance Check | See BREL | % DFEE < TFEE | | | 5.62 |
| % DPER < TPER | 10.41 | DPER | 63.71 | TPER | 71.11 |

| | | | |
|---|---|---|---|
| Assessor Details | Mr. Robert Tanner | Assessor ID | W344-0001 |
| Client | | | |

## SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

| | | |
|---|---|---|
| **Orientation** | Southeast | |
| **Property Tenture** | 1 | |
| **Transaction Type** | 6 | |
| **Terrain Type** | Suburban | |
| **1.0 Property Type** | Flat, End-Terrace | |
| Position of Flat | Mid-floor flat | |
| Which Floor | 2 | |
| **2.0 Number of Storeys** | 1 | |
| **3.0 Date Built** | 2026 | |
| **4.0 Sheltered Sides** | 2 | |
| **5.0 Sunlight/Shade** | Average or unknown | |
| **6.0 Thermal Mass Parameter** | Precise calculation | |
| Thermal Mass | 0.00 | kJ/m²K |
| **7.0 Electricity Tariff** | Standard | |
| Smart electricity meter fitted | Yes | |
| Smart gas meter fitted | Yes | |

**7.0 Measurements**

| | Heat Loss Perimeter | Internal Floor Area | Average Storey Height |
|---|---|---|---|
| **Ground floor:** | 34.12 m | 86.15 m² | 2.80 m |

| | | |
|---|---|---|
| **8.0 Living Area** | 38.77 | m² |

**9.0 External Walls**

| Description | Type | Construction | U-Value (W/m²K) | Kappa (kJ/m²K) | Gross Area(m²) | Nett Area (m²) | Shelter Res | Shelter | Openings | Area Calculation Type |
|---|---|---|---|---|---|---|---|---|---|---|
| External Wall 1 | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.15 | 70.00 | 54.88 | 41.43 | 0.00 | None | 13.45 | Enter Gross Area |
| Corridor wall | Cavity Wall | Cavity wall : dense plaster, AAC block, filled cavity, any outside structure | 0.22 | 70.00 | 40.66 | 38.24 | 0.90 | Stairwell Access Corridor 4 | 2.42 | Enter Gross Area |

**9.1 Party Walls**

| Description | Type | Construction | U-Value (W/m²K) | Kappa (kJ/m²K) | Area (m²) | Shelter Res | Shelter |
|---|---|---|---|---|---|---|---|
| Party Wall 1 | Filled Cavity with Edge Sealing | Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill | 0.00 | 70.00 | 27.86 | 0.00 | None |

**9.2 Internal Walls**

| Description | Construction | Kappa (kJ/m²K) | Area (m²) |
|---|---|---|---|
| Internal Wall 1 | Plasterboard on timber frame | 9.00 | 197.43 |

**10.1 Party Ceilings**

| Description | Construction | Kappa (kJ/m²K) | Area (m²) |
|---|---|---|---|
| Party Ceiling 1 | Precast concrete planks floor, screed, carpeted | 30.00 | 86.15 |

**11.1 Party Floors**

| Description | Storey Index | Construction | Kappa (kJ/m²K) | Area (m²) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Party Floor 1 | Lowest occupied | Precast concrete planks floor, screed, carpeted | 40.00 | 86.15 |

**12.0 Opening Types**

| Description | Data Source | Type | Glazing | Glazing Gap | Filling Type | G-value | Frame Type | Frame Factor | U Value (W/m²K) |
|---|---|---|---|---|---|---|---|---|---|
| Door | Manufacturer | Door to Corridor | | | | 0.00 | | | 1.00 |
| Window | Manufacturer | Window | Double Low-E Soft 0.1 | | | 0.35 | | 0.70 | 1.20 |

**13.0 Openings**

| Name | Opening Type | Location | Orientation | Area (m²) | Pitch |
|---|---|---|---|---|---|
| Door | Door | Corridor wall | South East | 2.42 | |
| NW windows | Window | External Wall 1 | North West | 7.48 | |
| NE windows | Window | External Wall 1 | North East | 5.96 | |

| | | |
|---|---|---|
| **14.0 Conservatory** | None | |
| **15.0 Draught Proofing** | 100 | % |
| **16.0 Draught Lobby** | No | |

| | |
|---|---|
| **17.0 Thermal Bridging** | Calculate Bridges |

**17.1 List of Bridges**

| Bridge Type | Source Type | Length | Psi | Adjusted Reference: | Imported |
|---|---|---|---|---|---|
| E1 Steel lintel with perforated steel base plate | Independently assessed | 8.49 | 0.05 | 0.05 | No |
| E4 Jamb | Independently assessed | 21.60 | 0.04 | 0.04 | No |
| E7 Party floor between dwellings (in blocks of flats) | Independently assessed | 30.48 | 0.05 | 0.05 | No |
| E7 Party floor between dwellings (in blocks of flats) | Independently assessed | 29.04 | 0.04 | 0.04 | No |
| E9 Balcony between dwellings, wall insulation continuous | Independently assessed | 8.72 | 0.05 | 0.05 | No |
| E16 Corner (normal) | Independently assessed | 5.60 | 0.05 | 0.05 | No |
| E16 Corner (normal) | Independently assessed | 5.60 | 0.04 | 0.04 | No |
| E17 Corner (inverted – internal area greater than external area) | Table K1 - Default | 2.80 | 0.00 | 0.00 | No |
| E18 Party wall between dwellings | Independently assessed | 2.80 | 0.05 | 0.05 | No |
| E25 Staggered party wall between dwellings | Independently assessed | 2.80 | 0.04 | 0.04 | No |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | Table K1 - Default | 19.90 | 0.00 | 0.00 | No |
| E3 Sill | Independently assessed | 4.99 | 0.04 | 0.04 | No |

**19.0 Mechanical Ventilation**

**Mechanical Ventilation**

| | |
|---|---|
| Mechanical Ventilation System Present | Yes |
| Approved Installation | Yes |
| Mechanical Ventilation data Type | Database |
| Type | Balanced mechanical ventilation with heat recovery |
| MV Reference Number | 500625 |
| Configuration | 2 |
| Manufacturer SFP | 0.61 |
| Duct Type | Rigid |
| MVHR Efficiency | 89.00 |
| Wet Rooms | 2 |
| SFP from Installer Commissioning Certificate | No |
| MVHR System Location | Inside heated envelope (installed exclusively) |
| Duct Installation Specification | Level 1 |

**20.0 Fans, Open Fireplaces, Flues**

| | |
|---|---|
| Number of open chimneys | 0 |
| Number of open flues | 0 |
| Number of chimneys/flues attached to closed fire | 0 |
| Number of flues attached to solid fuel boiler | 0 |
| Number of flues attached to other heater | 0 |
| Number of blocked chimneys | 0 |
| Number of intermittent extract fans | 0 |
| Number of passive vents | 0 |
| Number of flueless gas fires | 0 |

# Summary for Input Data

elmhurst energy

| | | |
|---|---|---|
| **21.0 Fixed Cooling System** | No | |
| **22.0 Pressure Testing** | Yes | |
| Designed $AP_{50}$ | 3.00 | m³/(h.m²) @ 50 Pa |
| Test Method | Blower Door | |

**22.0 Lighting**

No Fixed Lighting: No

| Name | Efficacy | Power | Capacity | Count |
|---|---|---|---|---|
| Lighting 1 | 75.00 | 15.00 | 1125.00 | 8 |

| | | |
|---|---|---|
| **24.0 Main Heating 1** | Manufacturer | |
| Percentage of Heat | 100.00 | % |
| Fuel Type | Mains gas | |
| SAP Code | 102 | |
| In Winter | 88.80 | |
| In Summer | 79.80 | |
| Model Name | x | |
| Manufacturer | x | |
| Controls SAP Code | 2110 | |
| Delayed Start Stat | Yes | |
| Burner Control | Modulating | |
| Flue Type | Balanced | |
| Fan Assisted Flue | Yes | |
| Is MHS Pumped | Pump in heated space | |
| Heating Pump Age | 2013 or later | |
| Heat Emitter | Radiators | |
| Flow Temperature | Enter value | |
| Flow Temperature Value | 55.00 | |
| Boiler Interlock | Yes | |
| **25.0 Main Heating 2** | None | |
| **26.0 Heat Networks** | None | |
| **27.0 Secondary Heating** | None | |

**28.0 Water Heating**

| | |
|---|---|
| Water Heating | Main Heating 1 |
| SAP Code | 901 |
| Flue Gas Heat Recovery System | No |
| Waste Water Heat Recovery Instantaneous System 1 | No |
| Waste Water Heat Recovery Instantaneous System 2 | No |
| Waste Water Heat Recovery Storage System | No |
| Solar Panel | No |
| Water use <= 125 litres/person/day | Yes |
| Cold Water Source | From header tank |
| Bath Count | 1 |

**28.1 Showers**

| Description | Shower Type | Flow Rate [l/min] | Rated Power [kW] | Connected | Connected To |
|---|---|---|---|---|---|
| Shower | Combi boiler or unvented hot water system | 8.00 | | No | |
| Shower 2 | Combi boiler or unvented hot water system | 8.00 | | No | |

**28.3 Waste Water Heat Recovery System**

| | |
|---|---|
| **29.0 Hot Water Cylinder** | Hot Water Cylinder |

# Summary for Input Data

| | | |
|---|---|---|
| Cylinder Stat | Yes | |
| Cylinder In Heated Space | Yes | |
| Independent Time Control | Yes | |
| Insulation Type | Measured Loss | |
| Cylinder Volume | 180.00 | L |
| Loss | 1.20 | kWh/day |
| Pipes insulation | Fully insulated primary pipework | |

| | |
|---|---|
| **31.0 Thermal Store** | None |

**Recommendations**

**Lower cost measures**

**None**

**Further measures to achieve even higher standards**

**None**

# Full SAP Calculation Printout

| | | | |
|---|---|---|---|
| Plot Reference | A 205 | Issued on Date | 19/03/2026 |
| Assessment Reference | Be Lean | Plot Type Ref | |
| Plot Address | | SAP Version | 10.2 |

| | | | | | |
|---|---|---|---|---|---|
| SAP Rating | 86 B | DER | 10.98 | TER | 13.17 |
| Environmental | 91 B | % DER < TER | | | 16.63 |
| $CO_2$ Emissions (t/year) | 0.85 | DFEE | 32.57 | TFEE | 34.51 |
| Compliance Check | See BREL | % DFEE < TFEE | | | 5.62 |
| % DPER < TPER | 10.41 | DPER | 63.71 | TPER | 71.11 |

| | | | |
|---|---|---|---|
| Assessor Details | Mr. Robert Tanner | Assessor ID | W344-0001 |
| 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
---

| | Area (m2) | | Storey height (m) | | Volume (m3) | |
|---|---|---|---|---|---|---|
| Main dwelling | | | | | | |
| Ground floor | 86.1500 | (1b) | x 2.8000 | (2b) = | 241.2200 | (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 86.1500 | | | | | (4) |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 241.2200 | (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 | 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) |

---
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 | |
|---|---|---|---|---|---|---|---|---|
| Main dwelling | | | | | | | | |
| Door | | | 2.4200 | 1.0000 | 2.4200 | | | (26) |
| Window | | | 13.4500 | 1.1450 | 15.4008 | | | (27) |
| External Wall 1 | 54.8800 | 13.4500 | 41.4300 | 0.1500 | 6.2145 | 70.0000 | 2900.1001 | (29a) |
| Corridor wall | 40.6600 | 2.4200 | 38.2400 | 0.1800 | 6.8832 | 70.0000 | 2676.8000 | (29a) |
| Total net area of external elements Aum(A, m2) | | | 95.5400 | | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 30.9185 | | | (33) |
| Main dwelling | | | | | | | | |
| Party Wall 1 | | | 27.8600 | 0.0000 | 0.0000 | 70.0000 | 1950.2000 | (32) |
| Party Floor 1 | | | 86.1500 | | | 40.0000 | 3446.0000 | (32d) |
| Party Ceiling 1 | | | 86.1500 | | | 30.0000 | 2584.5000 | (32b) |
| Internal Wall 1 | | | 197.4300 | | | 9.0000 | 1776.8699 | (32c) |

| | | |
|---|---|---|
| Heat capacity Cm = Sum(A x k) | (28)...(30) + (32) + (32a)...(32e) = 15334.4700 | (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | 177.9973 | (35) |
| List of Thermal Bridges | | |

| K1 Element | Length | Psi-value | Total |
|---|---|---|---|
| E1 Steel lintel with perforated steel base plate | 8.4900 | 0.0500 | 0.4245 |
| E4 Jamb | 21.6000 | 0.0400 | 0.8640 |
| E7 Party floor between dwellings (in blocks of flats) | 30.4800 | 0.0500 | 1.5240 |
| E7 Party floor between dwellings (in blocks of flats) | 29.0400 | 0.0360 | 1.0454 |
| E9 Balcony between dwellings, wall insulation continuous | 8.7200 | 0.0500 | 0.4360 |
| E16 Corner (normal) | 5.6000 | 0.0500 | 0.2800 |
| E16 Corner (normal) | 5.6000 | 0.0360 | 0.2016 |
| E17 Corner (inverted - internal area greater than external area) | 2.8000 | 0.0000 | 0.0000 |
| E18 Party wall between dwellings | 2.8000 | 0.0500 | 0.1400 |
| E25 Staggered party wall between dwellings | 2.8000 | 0.0360 | 0.1008 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 19.9000 | 0.0000 | 0.0000 |
| E3 Sill | 4.9900 | 0.0400 | 0.1996 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2159 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.1344 (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 | 20.8609 | 20.6071 | 20.3534 | 19.0847 | 18.8310 | 17.5623 | 17.5623 | 17.3086 | 18.0698 | 18.8310 | 19.3385 | 19.8459 | (38) |
| Heat transfer coeff | 56.9953 | 56.7415 | 56.4878 | 55.2191 | 54.9654 | 53.6967 | 53.6967 | 53.4430 | 54.2042 | 54.9654 | 55.4729 | 55.9803 | (39) |

Average = Sum(39)m / 12 = 55.1557

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.6616 | 0.6586 | 0.6557 | 0.6410 | 0.6380 | 0.6233 | 0.6233 | 0.6203 | 0.6292 | 0.6380 | 0.6439 | 0.6498 | (40) |
| HLP (average) | | | | | | | | | | | | 0.6402 | |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

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

Assumed occupancy 2.5693 (42)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hot water usage for mixer showers | 65.5977 | 64.5934 | 63.1134 | 60.8365 | 58.7966 | 55.9426 | 53.6853 | 56.3242 | 57.6515 | 60.4782 | 63.4219 | 65.5386 | (42a) |
| Hot water usage for baths | 28.4157 | 27.9867 | 27.3765 | 26.4626 | 25.6390 | 24.5053 | 23.6451 | 24.6969 | 25.2489 | 26.3723 | 27.5403 | 28.3931 | (42b) |
| Hot water usage for other uses | 40.9419 | 39.4531 | 37.9643 | 36.4755 | 34.9867 | 33.4979 | 33.4979 | 34.9867 | 36.4755 | 37.9643 | 39.4531 | 40.9419 | (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 124.0440 | (43) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily hot water use | 134.9553 | 132.0333 | 128.4542 | 123.7747 | 119.4223 | 113.9458 | 110.8284 | 116.0079 | 119.3760 | 124.8148 | 130.4154 | 134.8736 | (44) |
| Energy conte | 198.6775 | 174.7067 | 183.5584 | 161.6807 | 153.8877 | 131.7745 | 122.4686 | 136.5434 | 138.4701 | 160.8365 | 176.2607 | 198.0718 | (45) |
| Energy content (annual) | | | | | | | | | | Total = Sum(45)m = | | 1936.9369 | |
| Distribution loss (46)m = 0.15 x (45)m | 29.8016 | 26.2060 | 27.5338 | 24.2521 | 23.0832 | 19.7662 | 18.3703 | 20.4815 | 20.7705 | 24.1255 | 26.4391 | 29.7108 | (46) |
| Water storage loss (or HIU loss): | | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 180.0000 | (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.2000 | (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 | (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.6480 | (55) |
| Total storage loss | 20.0880 | 18.1440 | 20.0880 | 19.4400 | 20.0880 | 19.4400 | 20.0880 | 20.0880 | 19.4400 | 20.0880 | 19.4400 | 20.0880 | (56) |
| If cylinder contains dedicated solar storage | 20.0880 | 18.1440 | 20.0880 | 19.4400 | 20.0880 | 19.4400 | 20.0880 | 20.0880 | 19.4400 | 20.0880 | 19.4400 | 20.0880 | (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 | 242.0279 | 213.8619 | 226.9088 | 203.6327 | 197.2381 | 173.7265 | 165.8190 | 179.8938 | 180.4221 | 204.1869 | 218.2127 | 241.4222 | (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 | 242.0279 | 213.8619 | 226.9088 | 203.6327 | 197.2381 | 173.7265 | 165.8190 | 179.8938 | 180.4221 | 204.1869 | 218.2127 | 241.4222 | (64) |
| | | | | | | | | | Total per year (kWh/year) = Sum(64)m = | | | 2447.3529 | (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | 2447 | (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 | 100.7406 | 89.4141 | 95.7135 | 87.3204 | 85.8480 | 77.3766 | 75.4011 | 80.0810 | 79.6029 | 88.1585 | 92.1683 | 100.5392 | (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 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 122.5838 | 135.7178 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.8138 | 234.2193 | 228.1576 | 215.2527 | 198.9627 | 183.6524 | 173.4241 | 171.0186 | 177.0804 | 189.9852 | 206.2753 | 221.5856 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | (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) | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | (71) |
| Water heating gains (Table 5) | 135.4040 | 133.0568 | 128.6472 | 121.2784 | 115.3871 | 107.4676 | 101.3456 | 107.6358 | 110.5596 | 118.4926 | 128.0115 | 135.1333 | (72) |
| Total internal gains | 554.3408 | 567.5330 | 543.9276 | 527.7401 | 501.4727 | 479.3289 | 458.8927 | 462.7773 | 475.8491 | 495.6007 | 525.4958 | 543.8418 | (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 | |
|---|---|---|---|---|---|---|---|
| Northeast | 5.9600 | 11.2829 | 0.3500 | 0.7000 | 0.7700 | 11.4174 | (75) |
| Northwest | 7.4900 | 11.2829 | 0.3500 | 0.7000 | 0.7700 | 14.3484 | (81) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar gains | 25.7658 | 52.4471 | 94.4929 | 155.1845 | 208.5985 | 222.3881 | 208.0395 | 165.8515 | 115.1411 | 64.0945 | 32.4201 | 21.0417 | (83) |
| Total gains | 580.1066 | 619.9801 | 638.4206 | 682.9247 | 710.0712 | 701.7170 | 666.9321 | 628.6288 | 590.9902 | 559.6952 | 557.9159 | 564.8835 | (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 | 74.7356 | 75.0698 | 75.4070 | 77.1395 | 77.4956 | 79.3265 | 79.3265 | 79.7032 | 78.5839 | 77.4956 | 76.7866 | 76.0906 | |
| alpha | 5.9824 | 6.0047 | 6.0271 | 6.1426 | 6.1664 | 6.2884 | 6.2884 | 6.3135 | 6.2389 | 6.1664 | 6.1191 | 6.0727 | |
| util living area | 0.9792 | 0.9664 | 0.9406 | 0.8504 | 0.6905 | 0.4869 | 0.3539 | 0.3904 | 0.6190 | 0.8694 | 0.9576 | 0.9814 | (86) |
| MIT | 20.3011 | 20.4271 | 20.6013 | 20.8400 | 20.9618 | 20.9964 | 20.9996 | 20.9993 | 20.9849 | 20.8441 | 20.5667 | 20.2948 | (87) |
| Th 2 | 20.3749 | 20.3775 | 20.3801 | 20.3933 | 20.3959 | 20.4091 | 20.4091 | 20.4117 | 20.4038 | 20.3959 | 20.3906 | 20.3854 | (88) |
| util rest of house | 0.9751 | 0.9602 | 0.9295 | 0.8266 | 0.6528 | 0.4430 | 0.3066 | 0.3408 | 0.5700 | 0.8433 | 0.9488 | 0.9779 | (89) |
| MIT 2 | 19.5559 | 19.7159 | 19.9340 | 20.2285 | 20.3619 | 20.4066 | 20.4089 | 20.4113 | 20.3925 | 20.2396 | 19.9025 | 19.5564 | (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.4500 | (91) |
| MIT | 19.8913 | 20.0360 | 20.2343 | 20.5037 | 20.6319 | 20.6720 | 20.6747 | 20.6759 | 20.6591 | 20.5117 | 20.2014 | 19.8887 | (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 | |
| adjusted MIT | 19.7413 | 19.8860 | 20.0843 | 20.3537 | 20.4819 | 20.5220 | 20.5247 | 20.5259 | 20.5091 | 20.3617 | 20.0514 | 19.7387 | (93) |

## 8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.9702 | 0.9544 | 0.9236 | 0.8249 | 0.6583 | 0.4514 | 0.3158 | 0.3505 | 0.5788 | 0.8417 | 0.9430 | 0.9733 | (94) |
| Useful gains | 562.8286 | 591.6931 | 589.6257 | 563.3643 | 467.4346 | 316.7895 | 210.6415 | 220.3098 | 342.0826 | 471.0677 | 526.1380 | 549.7758 | (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 | 880.0807 | 850.3284 | 767.3494 | 632.4619 | 482.6995 | 317.9918 | 210.7445 | 220.5019 | 347.3993 | 536.5542 | 718.4527 | 869.8604 | (97) |
| Space heating kWh | 236.0355 | 173.8030 | 132.2264 | 49.7503 | 11.3571 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 48.7219 | 138.4665 | 238.1430 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 1028.5037 | |
| 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 | 236.0355 | 173.8030 | 132.2264 | 49.7503 | 11.3571 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 48.7219 | 138.4665 | 238.1430 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 1028.5037 | |
| Space heating per m2 | | | | | | | | | | | (98c) / (4) = | 11.9385 | (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 %) | 88.8000 | (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 | 236.0355 | 173.8030 | 132.2264 | 49.7503 | 11.3571 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 48.7219 | 138.4665 | 238.1430 | (98) |
| Space heating efficiency (main heating system 1) | 88.8000 | 88.8000 | 88.8000 | 88.8000 | 88.8000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 88.8000 | 88.8000 | 88.8000 | (210) |
| Space heating fuel (main heating system) | 265.8058 | 195.7240 | 148.9036 | 56.0251 | 12.7895 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 54.8670 | 155.9308 | 268.1790 | (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 | 242.0279 | 213.8619 | 226.9088 | 203.6327 | 197.2381 | 173.7265 | 165.8190 | 179.8938 | 180.4221 | 204.1869 | 218.2127 | 241.4222 | (64) |
| Efficiency of water heater | | | | | | | | | | | | 79.8000 | (216) |
| (217)m | 84.0036 | 83.5987 | 82.8932 | 81.4202 | 80.2428 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 81.3891 | 83.0684 | 84.0291 | (217) |
| Fuel for water heating, kWh/month | 288.1162 | 255.8198 | 273.7363 | 250.1008 | 245.8017 | 217.7024 | 207.7933 | 225.4309 | 226.0929 | 250.8774 | 262.6905 | 287.3078 | (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 | 26.3623 | 23.8111 | 26.3623 | 25.5119 | 26.3623 | 25.5119 | 26.3623 | 26.3623 | 25.5119 | 26.3623 | 25.5119 | 26.3623 | (231) |
| Lighting | 26.6176 | 21.3537 | 19.2266 | 14.0862 | 10.8806 | 8.8896 | 9.9257 | 12.9017 | 16.7581 | 21.9875 | 24.8349 | 27.3574 | (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 | 1158.2248 | (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 | 2991.4701 | (219) |
| Space cooling fuel | 0.0000 | (221) |

Electricity for pumps and fans:

| | | |
|---|---|---|
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625) | | |
| mechanical ventilation fans (SFP = 0.7625) | 224.3949 | (230a) |
| central heating pump | 41.0000 | (230c) |
| main heating flue fan | 45.0000 | (230e) |
| Total electricity for the above, kWh/year | 310.3949 | (231) |
| Electricity for lighting (calculated in Appendix L) | 214.8196 | (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 | 4674.9095 | (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 | 1158.2248 | 0.2100 | 243.2272 | (261) |
| Total CO2 associated with community systems | | | 0.0000 | (373) |
| Water heating (other fuel) | 2991.4701 | 0.2100 | 628.2087 | (264) |
| Space and water heating | | | 871.4359 | (265) |
| Pumps, fans and electric keep-hot | 310.3949 | 0.1387 | 43.0556 | (267) |
| Energy for lighting | 214.8196 | 0.1443 | 31.0051 | (268) |
| Total CO2, kg/year | | | 945.4966 | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) | | | 10.9800 | (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 | 1158.2248 | 1.1300 | 1308.7941 | (275) |
| Total CO2 associated with community systems | | | 0.0000 | (473) |
| Water heating (other fuel) | 2991.4701 | 1.1300 | 3380.3612 | (278) |
| Space and water heating | | | 4689.1553 | (279) |
| Pumps, fans and electric keep-hot | 310.3949 | 1.5128 | 469.5654 | (281) |
| Energy for lighting | 214.8196 | 1.5338 | 329.4975 | (282) |
| Total Primary energy kWh/year | | | 5488.2182 | (286) |
| Dwelling Primary energy Rate (DPER) | | | 63.7100 | (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) | |
|---|---|---|---|---|---|---|
| Main dwelling | | | | | | |
| Ground floor | 86.1500 | (1b) x | 2.8000 | (2b) = | 241.2200 | (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 86.1500 | | | | | (4) |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 241.2200 | (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) = | 0.1244 | (8) |
| Pressure test | | Yes | |
| Pressure Test Method | | Blower Door | |
| Measured/design AP50 | | 5.0000 | (17) |
| Infiltration rate | | 0.3744 | (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) = | 0.3182 | (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 | 0.4057 | 0.3978 | 0.3898 | 0.3500 | 0.3421 | 0.3023 | 0.3023 | 0.2943 | 0.3182 | 0.3421 | 0.3580 | 0.3739 | (22b) |
| Effective ac | 0.5823 | 0.5791 | 0.5760 | 0.5613 | 0.5585 | 0.5457 | 0.5457 | 0.5433 | 0.5506 | 0.5585 | 0.5641 | 0.5699 | (25) |

## 3. Heat losses and heat loss parameter

| Element | Gross | Openings | NetArea | U-value | A x U | K-value | A x K | |
|---|---|---|---|---|---|---|---|---|
| Main dwelling | m2 | m2 | m2 | W/m2K | W/K | kJ/m2K | kJ/K | |
| TER Opaque door | | | 2.4200 | 1.0000 | 2.4200 | | | (26) |
| TER Opening Type | | | 13.4500 | 1.1450 | 15.4008 | | | (27) |
| External Wall 1 | 54.8800 | 13.4500 | 41.4300 | 0.1800 | 7.4574 | | | (29a) |
| Corridor wall | 40.6600 | 2.4200 | 38.2400 | 0.1800 | 6.8832 | | | (29a) |
| Total net area of external elements Aum(A, m2) | | | 95.5400 | | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | (26)...(30) + (32) = | | 32.1614 | | | (33) |
| Main dwelling | | | | | | | | |
| Party Wall 1 | | | 27.8600 | 0.0000 | 0.0000 | | | (32) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 177.9973 (35)

List of Thermal Bridges

| K1 Element | Length | Psi-value | Total |
|---|---|---|---|
| E1 Steel lintel with perforated steel base plate | 8.4900 | 0.0500 | 0.4245 |
| E4 Jamb | 21.6000 | 0.0500 | 1.0800 |
| E7 Party floor between dwellings (in blocks of flats) | 30.4800 | 0.0700 | 2.1336 |
| E7 Party floor between dwellings (in blocks of flats) | 29.0400 | 0.0700 | 2.0328 |
| E9 Balcony between dwellings, wall insulation continuous | 8.7200 | 0.0200 | 0.1744 |
| E16 Corner (normal) | 5.6000 | 0.0900 | 0.5040 |
| E16 Corner (normal) | 5.6000 | 0.0900 | 0.5040 |
| E17 Corner (inverted - internal area greater than external area) | 2.8000 | -0.0900 | -0.2520 |
| E18 Party wall between dwellings | 2.8000 | 0.0600 | 0.1680 |
| E25 Staggered party wall between dwellings | 2.8000 | 0.0600 | 0.1680 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 19.9000 | 0.0000 | 0.0000 |
| E3 Sill | 4.9900 | 0.0500 | 0.2495 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.1868 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 39.3482 (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m | 46.3530 | 46.0986 | 45.8492 | 44.6779 | 44.4588 | 43.4386 | 43.4386 | 43.2497 | 43.8316 | 44.4588 | 44.9021 | 45.3656 | (38) |
| Heat transfer coeff | 85.7011 | 85.4467 | 85.1974 | 84.0261 | 83.8069 | 82.7868 | 82.7868 | 82.5978 | 83.1797 | 83.8069 | 84.2502 | 84.7137 | (39) |

Average = Sum(39)m / 12 = 84.0250

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.9948 | 0.9918 | 0.9889 | 0.9753 | 0.9728 | 0.9610 | 0.9610 | 0.9588 | 0.9655 | 0.9728 | 0.9779 | 0.9833 | (40) |
| HLP (average) | | | | | | | | | | | | 0.9753 | |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

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

Assumed occupancy 2.5693 (42)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hot water usage for mixer showers | 67.2980 | 66.2866 | 64.8129 | 61.9931 | 59.9122 | 57.5916 | 56.2726 | 57.7352 | 59.3385 | 61.8301 | 64.7104 | 67.0402 | (42a) |
| Hot water usage for baths | 29.0636 | 28.6319 | 28.0241 | 26.9034 | 26.0642 | 25.1336 | 24.6310 | 25.2346 | 25.8918 | 26.8875 | 28.0313 | 28.9653 | (42b) |
| Hot water usage for other uses | 40.9419 | 39.4531 | 37.9643 | 36.4755 | 34.9867 | 33.4979 | 33.4979 | 34.9867 | 36.4755 | 37.9643 | 39.4531 | 40.9419 | (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 126.2129 | (43) |
| Daily hot water use | 137.3035 | 134.3717 | 130.8013 | 125.3720 | 120.9632 | 116.2232 | 114.4016 | 117.9565 | 121.7058 | 126.6819 | 132.1948 | 136.9474 | (44) |
| Energy conte | 217.4552 | 191.3435 | 201.0368 | 171.6281 | 162.8397 | 142.9100 | 138.3588 | 146.0548 | 150.0754 | 171.9062 | 188.3358 | 214.4265 | (45) |
| Energy content (annual) | | | | | | | | | | Total = Sum(45)m = | | 2096.3707 | |
| Distribution loss (46)m = 0.15 x (45)m | 32.6183 | 28.7015 | 30.1555 | 25.7442 | 24.4259 | 21.4365 | 20.7538 | 21.9082 | 22.5113 | 25.7859 | 28.2504 | 32.1640 | (46) |
| Water storage loss (or HIU loss): | | | | | | | | | | | | | |
| Store volume | | | | | | | | | | | | 180.0000 | (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 1.5520 | (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 | (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 0.8381 | (55) |
| Total storage loss | 25.9803 | 23.4661 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 | (56) |
| If cylinder contains dedicated solar storage | 25.9803 | 23.4661 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 | 25.9803 | 25.1422 | 25.9803 | 25.1422 | 25.9803 | (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 | 266.6978 | 235.8208 | 250.2794 | 219.2823 | 212.0823 | 190.5642 | 187.6014 | 195.2975 | 197.7296 | 221.1488 | 235.9900 | 263.6692 | (62) |
| WWHRS | -30.7658 | -27.2096 | -28.4923 | -23.5927 | -21.9876 | -18.8149 | -17.6360 | -18.7541 | -19.4667 | -22.9490 | -25.9985 | -30.1961 | (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 | 235.9320 | 208.6112 | 221.7872 | 195.6895 | 190.0947 | 171.7493 | 169.9654 | 176.5434 | 178.2630 | 198.1998 | 209.9915 | 233.4731 | (64) |
| | | | | | | | | Total per year (kWh/year) = Sum(64)m = | | | | 2390.3001 | (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | 2390 | (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 | 111.6980 | 99.2035 | 106.2389 | 95.1897 | 93.5383 | 85.6409 | 85.3984 | 87.9574 | 88.0234 | 96.5529 | 100.7450 | 110.6910 | (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 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 122.5838 | 135.7178 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.8138 | 234.2193 | 228.1576 | 215.2527 | 198.9627 | 183.6524 | 173.4241 | 171.0186 | 177.0804 | 189.9852 | 206.2753 | 221.5856 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | (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) | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 150.1317 | 147.6243 | 142.7942 | 132.2079 | 125.7235 | 118.9457 | 114.7828 | 118.2223 | 122.2548 | 129.7755 | 139.9236 | 148.7782 | (72) |
| Total internal gains | 569.0684 | 582.1005 | 558.0746 | 538.6697 | 511.8091 | 490.8071 | 472.3299 | 473.3638 | 487.5442 | 506.8836 | 537.4079 | 557.4867 | (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 | |
|---|---|---|---|---|---|---|---|
| Northeast | 5.9600 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 20.5514 | (75) |
| Northwest | 7.4900 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 25.8271 | (81) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar gains | 46.3785 | 94.4047 | 170.0873 | 279.3322 | 375.4773 | 400.2985 | 374.4710 | 298.5327 | 207.2540 | 115.3701 | 58.3561 | 37.8750 | (83) |
| Total gains | 615.4469 | 676.5052 | 728.1619 | 818.0018 | 887.2864 | 891.1056 | 846.8009 | 771.8964 | 694.7982 | 622.2536 | 595.7640 | 595.3617 | (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 | 49.7027 | 49.8506 | 49.9966 | 50.6935 | 50.8261 | 51.4524 | 51.4524 | 51.5700 | 51.2093 | 50.8261 | 50.5586 | 50.2820 | |
| alpha | 4.3135 | 4.3234 | 4.3331 | 4.3796 | 4.3884 | 4.4302 | 4.4302 | 4.4380 | 4.4140 | 4.3884 | 4.3706 | 4.3521 | |
| util living area | 0.9849 | 0.9758 | 0.9558 | 0.8907 | 0.7581 | 0.5690 | 0.4243 | 0.4812 | 0.7302 | 0.9221 | 0.9737 | 0.9868 | (86) |
| MIT | 19.6202 | 19.8025 | 20.0967 | 20.5158 | 20.8205 | 20.9615 | 20.9916 | 20.9857 | 20.8878 | 20.4993 | 20.0076 | 19.5985 | (87) |
| Th 2 | 20.0877 | 20.0901 | 20.0926 | 20.1039 | 20.1061 | 20.1160 | 20.1160 | 20.1178 | 20.1122 | 20.1061 | 20.1018 | 20.0972 | (88) |
| util rest of house | 0.9815 | 0.9705 | 0.9457 | 0.8664 | 0.7104 | 0.4992 | 0.3417 | 0.3938 | 0.6629 | 0.8994 | 0.9669 | 0.9838 | (89) |
| MIT 2 | 18.4804 | 18.7127 | 19.0838 | 19.6022 | 19.9461 | 20.0904 | 20.1123 | 20.1111 | 20.0268 | 19.5947 | 18.9826 | 18.4596 | (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.4500 | (91) |
| MIT | 18.9934 | 19.2031 | 19.5396 | 20.0134 | 20.3397 | 20.4824 | 20.5080 | 20.5047 | 20.4143 | 20.0018 | 19.4439 | 18.9721 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 18.9934 | 19.2031 | 19.5396 | 20.0134 | 20.3397 | 20.4824 | 20.5080 | 20.5047 | 20.4143 | 20.0018 | 19.4439 | 18.9721 | (93) |

## 8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.9762 | 0.9638 | 0.9383 | 0.8637 | 0.7236 | 0.5288 | 0.3787 | 0.4328 | 0.6872 | 0.8963 | 0.9606 | 0.9789 | (94) |
| Useful gains | 600.7756 | 652.0355 | 683.2104 | 706.5064 | 642.0573 | 471.2030 | 320.7009 | 334.0463 | 477.4342 | 557.7380 | 572.2921 | 582.8166 | (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 | 1259.2376 | 1222.1555 | 1110.9399 | 933.8124 | 724.0627 | 486.9868 | 323.5323 | 339.0382 | 525.2198 | 787.9348 | 1039.9747 | 1251.4023 | (97) |
| Space heating kWh | 489.8957 | 383.1207 | 318.2307 | 163.6603 | 61.0120 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 171.2664 | 336.7315 | 497.4278 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 2421.3451 | |
| 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 | 489.8957 | 383.1207 | 318.2307 | 163.6603 | 61.0120 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 171.2664 | 336.7315 | 497.4278 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 2421.3451 | |
| Space heating per m2 | | | | | | | | | | (98c) / (4) = | | 28.1062 | (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 | 489.8957 | 383.1207 | 318.2307 | 163.6603 | 61.0120 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 171.2664 | 336.7315 | 497.4278 | (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) | 530.7646 | 415.0820 | 344.7787 | 177.3134 | 66.1019 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 185.5541 | 364.8228 | 538.9250 | (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 | 235.9320 | 208.6112 | 221.7872 | 195.6895 | 190.0947 | 171.7493 | 169.9654 | 176.5434 | 178.2630 | 198.1998 | 209.9915 | 233.4731 | (64) |
| Efficiency of water heater | | | | | | | | | | | | 79.8000 | (216) |
| (217)m | 85.6597 | 85.4043 | 84.8689 | 83.6617 | 81.8147 | 79.8000 | 79.8000 | 79.8000 | 79.8000 | 83.7339 | 85.1130 | 85.7121 | (217) |
| Fuel for water heating, kWh/month | 275.4294 | 244.2632 | 261.3292 | 233.9057 | 232.3478 | 215.2247 | 212.9893 | 221.2323 | 223.3872 | 236.7018 | 246.7208 | 272.3922 | (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 | 25.4705 | 20.4334 | 18.3980 | 13.4792 | 10.4117 | 8.5064 | 9.4979 | 12.3457 | 16.0359 | 21.0399 | 23.7645 | 26.1784 | (232) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | | | | | | | | | | | | |
| (233a)m | -11.3405 | -17.4271 | -27.2724 | -33.4685 | -38.6258 | -36.9911 | -36.5388 | -33.2126 | -27.8429 | -21.0978 | -12.9666 | -9.6440 | (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 | -2.6751 | -5.8434 | -12.0349 | -18.7195 | -25.4061 | -25.7772 | -25.4785 | -21.2704 | -15.1995 | -8.5634 | -3.6351 | -2.0999 | (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 | 2623.3424 | (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 | 2875.9234 | (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) | 205.5615 | (232) |
| | | |
| Energy saving/generation technologies (Appendices M ,N and Q) | | |
| PV generation | -473.1311 | (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 | 5317.6962 | (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 | 2623.3424 | 0.2100 | 550.9019 | (261) |
| Total CO2 associated with community systems | | | 0.0000 | (373) |
| Water heating (other fuel) | 2875.9234 | 0.2100 | 603.9439 | (264) |
| Space and water heating | | | 1154.8458 | (265) |
| Pumps, fans and electric keep-hot | 86.0000 | 0.1387 | 11.9293 | (267) |
| Energy for lighting | 205.5615 | 0.1443 | 29.6689 | (268) |
| | | | | |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -306.4281 | 0.1328 | -40.7047 | |
| PV Unit electricity exported | -166.7029 | 0.1249 | -20.8184 | |
| Total | | | -61.5231 | (269) |
| Total CO2, kg/year | | | 1134.9208 | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) | | | 13.1700 | (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 | 2623.3424 | 1.1300 | 2964.3769 | (275) |
| Total CO2 associated with community systems | | | 0.0000 | (473) |
| Water heating (other fuel) | 2875.9234 | 1.1300 | 3249.7934 | (278) |
| Space and water heating | | | 6214.1704 | (279) |
| Pumps, fans and electric keep-hot | 86.0000 | 1.5128 | 130.1008 | (281) |
| Energy for lighting | 205.5615 | 1.5338 | 315.2970 | (282) |
| | | | | |
| Energy saving/generation technologies | | | | |
| PV Unit electricity used in dwelling | -306.4281 | 1.4908 | -456.8351 | |
| PV Unit electricity exported | -166.7029 | 0.4584 | -76.4094 | |
| Total | | | -533.2445 | (283) |
| Total Primary energy kWh/year | | | 6126.3237 | (286) |
| Target Primary Energy Rate (TPER) | | | 71.1100 | (287) |

# Full SAP Calculation Printout

| | | | |
|---|---|---|---|
| Plot Reference | A 205 | Issued on Date | 19/03/2026 |
| Assessment Reference | Be Lean | Plot Type Ref | |
| Plot Address | | SAP Version | 10.2 |

| | | | | | |
|---|---|---|---|---|---|
| SAP Rating | 86 B | DER | 10.98 | TER | 13.17 |
| Environmental | 91 B | % DER < TER | | | 16.63 |
| $CO_2$ Emissions (t/year) | 0.85 | DFEE | 32.57 | TFEE | 34.51 |
| Compliance Check | See BREL | % DFEE < TFEE | | | 5.62 |
| % DPER < TPER | 10.41 | DPER | 63.71 | TPER | 71.11 |

| | | | |
|---|---|---|---|
| Assessor Details | Mr. Robert Tanner | Assessor ID | W344-0001 |
| Client | | | |

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

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| | Area (m2) | | Storey height (m) | | Volume (m3) | |
|---|---|---|---|---|---|---|
| Main dwelling | | | | | | |
| Ground floor | 86.1500 (1b) | x | 2.8000 (2b) | = | 241.2200 | (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 86.1500 | | | | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = | 241.2200 | (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 | 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) = | | 0.1244 | (8) |
| Pressure test | | | Yes | |
| Pressure Test Method | | | Blower Door | |
| Measured/design AP50 | | | 3.0000 | (17) |
| Infiltration rate | | | 0.2744 | (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) = | | 0.2332 | (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 | 0.2973 | 0.2915 | 0.2857 | 0.2565 | 0.2507 | 0.2216 | 0.2216 | 0.2157 | 0.2332 | 0.2507 | 0.2624 | 0.2740 | (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | | | | | | | | | | | | 0.0000 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | | | | | | | | | | | | 0.0000 | (23c) |
| Effective ac | 0.5442 | 0.5425 | 0.5408 | 0.5329 | 0.5314 | 0.5245 | 0.5245 | 0.5233 | 0.5272 | 0.5314 | 0.5344 | 0.5375 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Main dwelling | | | | | | | | |
| Door | | | 2.4200 | 1.0000 | 2.4200 | | | (26) |
| Window | | | 13.4500 | 1.1450 | 15.4008 | | | (27) |
| External Wall 1 | 54.8800 | 13.4500 | 41.4300 | 0.1500 | 6.2145 | 70.0000 | 2900.1001 | (29a) |
| Corridor wall | 40.6600 | 2.4200 | 38.2400 | 0.1800 | 6.8832 | 70.0000 | 2676.8000 | (29a) |
| Total net area of external elements Aum(A, m2) | | | 95.5400 | | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 30.9185 | | | (33) |
| Main dwelling | | | | | | | | |
| Party Wall 1 | | | 27.8600 | 0.0000 | 0.0000 | 70.0000 | 1950.2000 | (32) |
| Party Floor 1 | | | 86.1500 | | | 40.0000 | 3446.0000 | (32d) |
| Party Ceiling 1 | | | 86.1500 | | | 30.0000 | 2584.5000 | (32b) |
| Internal Wall 1 | | | 197.4300 | | | 9.0000 | 1776.8699 | (32c) |

| | | |
|---|---|---|
| Heat capacity Cm = Sum(A x k) | (28)...(30) + (32) + (32a)...(32e) = 15334.4700 | (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | 177.9973 | (35) |

List of Thermal Bridges

| | Length | Psi-value | Total |
|---|---|---|---|
| K1 Element | | | |
| E1 Steel lintel with perforated steel base plate | 8.4900 | 0.0500 | 0.4245 |
| E4 Jamb | 21.6000 | 0.0400 | 0.8640 |

| | | | |
|---|---|---|---|
| E7 Party floor between dwellings (in blocks of flats) | 30.4800 | 0.0500 | 1.5240 |
| E7 Party floor between dwellings (in blocks of flats) | 29.0400 | 0.0360 | 1.0454 |
| E9 Balcony between dwellings, wall insulation continuous | 8.7200 | 0.0500 | 0.4360 |
| E16 Corner (normal) | 5.6000 | 0.0500 | 0.2800 |
| E16 Corner (normal) | 5.6000 | 0.0360 | 0.2016 |
| E17 Corner (inverted - internal area greater than external area) | 2.8000 | 0.0000 | 0.0000 |
| E18 Party wall between dwellings | 2.8000 | 0.0500 | 0.1400 |
| E25 Staggered party wall between dwellings | 2.8000 | 0.0360 | 0.1008 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 19.9000 | 0.0000 | 0.0000 |
| E3 Sill | 4.9900 | 0.0400 | 0.1996 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2159 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.1344 (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 | 43.3203 | 43.1837 | 43.0497 | 42.4206 | 42.3029 | 41.7550 | 41.7550 | 41.6535 | 41.9660 | 42.3029 | 42.5410 | 42.7900 | (38) |
| Heat transfer coeff | | | | | | | | | | | | | |
| | 79.4547 | 79.3181 | 79.1841 | 78.5550 | 78.4373 | 77.8894 | 77.8894 | 77.7879 | 78.1004 | 78.4373 | 78.6754 | 78.9244 | (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 78.5544 | |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.9223 | 0.9207 | 0.9191 | 0.9118 | 0.9105 | 0.9041 | 0.9041 | 0.9029 | 0.9066 | 0.9105 | 0.9132 | 0.9161 | (40) |
| HLP (average) | | | | | | | | | | | | 0.9118 | |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

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

Assumed occupancy 2.5693 (42)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | | | | | | |
| | 28.4157 | 27.9867 | 27.3765 | 26.4626 | 25.6390 | 24.5053 | 23.6451 | 24.6969 | 25.2489 | 26.3723 | 27.5403 | 28.3931 | (42b) |
| Hot water usage for other uses | | | | | | | | | | | | | |
| | 40.9419 | 39.4531 | 37.9643 | 36.4755 | 34.9867 | 33.4979 | 33.4979 | 34.9867 | 36.4755 | 37.9643 | 39.4531 | 40.9419 | (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 63.5680 | (43) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily hot water use | | | | | | | | | | | | | |
| | 69.3576 | 67.4398 | 65.3408 | 62.9382 | 60.6258 | 58.0032 | 57.1431 | 59.6837 | 61.7245 | 64.3367 | 66.9934 | 69.3351 | (44) |
| Energy conte | 102.1064 | 89.2366 | 93.3707 | 82.2130 | 78.1224 | 67.0788 | 63.1448 | 70.2488 | 71.5973 | 82.9043 | 90.5439 | 101.8236 | (45) |
| Energy content (annual) | | | | | | | | | | Total = Sum(45)m = | | 992.3904 | |
| Distribution loss (46)m = 0.15 x (45)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 | (46) |
| Water storage loss (or HIU loss): | | | | | | | | | | | | | |
| Total storage loss | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (56) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) |
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (59) |
| Combi loss | 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 | | | | | | | | | | | | | |
| | 86.7904 | 75.8511 | 79.3651 | 69.8810 | 66.4041 | 57.0170 | 53.6731 | 59.7115 | 60.8577 | 70.4686 | 76.9623 | 86.5501 | (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 | | | | | | | | | | | | | |
| | 86.7904 | 75.8511 | 79.3651 | 69.8810 | 66.4041 | 57.0170 | 53.6731 | 59.7115 | 60.8577 | 70.4686 | 76.9623 | 86.5501 | (64) |
| | | | | | | | | Total per year (kWh/year) = Sum(64)m = | | | | 843.5318 | (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | 844 | (64) |
| Electric shower(s) | | | | | | | | | | | | | |
| | 53.8945 | 48.0204 | 52.4365 | 50.0395 | 50.9785 | 48.6285 | 50.2494 | 50.9785 | 50.0395 | 52.4365 | 51.4505 | 53.8945 | (64a) |
| | | | | | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | | | | | | | 613.0466 | (64a) |
| Heat gains from water heating, kWh/month | | | | | | | | | | | | | |
| | 35.1712 | 30.9679 | 32.9504 | 29.9801 | 29.3456 | 26.4114 | 25.9806 | 27.6725 | 27.7243 | 30.7263 | 32.1032 | 35.1111 | (65) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | | |
| (66)m | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| | 122.5838 | 135.7178 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| | 231.8138 | 234.2193 | 228.1576 | 215.2527 | 198.9627 | 183.6524 | 173.4241 | 171.0186 | 177.0804 | 189.9852 | 206.2753 | 221.5856 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | (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) | | | | | | | | | | | | | |
| | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| | 47.2731 | 46.0831 | 44.2882 | 41.6391 | 39.4431 | 36.6825 | 34.9202 | 37.1942 | 38.5060 | 41.2988 | 44.5878 | 47.1924 | (72) |
| Total internal gains | | | | | | | | | | | | | |
| | 463.2099 | 477.5594 | 456.5686 | 445.1008 | 422.5286 | 408.5438 | 392.4672 | 392.3357 | 403.7954 | 415.4069 | 439.0721 | 452.9009 | (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 | |
|---|---|---|---|---|---|---|---|
| Northeast | 5.9600 | 11.2829 | 0.3500 | 0.7000 | 0.7700 | 11.4174 | (75) |
| Northwest | 7.4900 | 11.2829 | 0.3500 | 0.7000 | 0.7700 | 14.3484 | (81) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar gains | 25.7658 | 52.4471 | 94.4929 | 155.1845 | 208.5985 | 222.3881 | 208.0395 | 165.8515 | 115.1411 | 64.0945 | 32.4201 | 21.0417 | (83) |
| Total gains | 488.9757 | 530.0064 | 551.0615 | 600.2854 | 631.1271 | 630.9319 | 600.5067 | 558.1872 | 518.9365 | 479.5014 | 471.4921 | 473.9426 | (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 | 53.6101 | 53.7025 | 53.7933 | 54.2241 | 54.3055 | 54.6875 | 54.6875 | 54.7588 | 54.5397 | 54.3055 | 54.1411 | 53.9703 | |
| alpha | 4.5740 | 4.5802 | 4.5862 | 4.6149 | 4.6204 | 4.6458 | 4.6458 | 4.6506 | 4.6360 | 4.6204 | 4.6094 | 4.5980 | |
| util living area | 0.9934 | 0.9895 | 0.9818 | 0.9522 | 0.8760 | 0.7146 | 0.5518 | 0.6094 | 0.8377 | 0.9627 | 0.9881 | 0.9943 | (86) |
| MIT | 19.5679 | 19.7182 | 19.9655 | 20.3532 | 20.6984 | 20.9186 | 20.9806 | 20.9698 | 20.8220 | 20.3953 | 19.9289 | 19.5426 | (87) |
| Th 2 | 20.1486 | 20.1499 | 20.1513 | 20.1574 | 20.1586 | 20.1640 | 20.1640 | 20.1650 | 20.1619 | 20.1586 | 20.1563 | 20.1538 | (88) |
| util rest of house | 0.9919 | 0.9870 | 0.9772 | 0.9394 | 0.8420 | 0.6442 | 0.4553 | 0.5119 | 0.7829 | 0.9503 | 0.9849 | 0.9930 | (89) |
| MIT 2 | 18.8304 | 18.9807 | 19.2269 | 19.6105 | 19.9331 | 20.1179 | 20.1568 | 20.1528 | 20.0471 | 19.6564 | 19.1958 | 18.8092 | (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.4500 | (91) |
| MIT | 19.1623 | 19.3126 | 19.5593 | 19.9447 | 20.2775 | 20.4783 | 20.5276 | 20.5205 | 20.3958 | 19.9889 | 19.5257 | 19.1393 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 19.1623 | 19.3126 | 19.5593 | 19.9447 | 20.2775 | 20.4783 | 20.5276 | 20.5205 | 20.3958 | 19.9889 | 19.5257 | 19.1393 | (93) |

## 8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.9895 | 0.9839 | 0.9732 | 0.9356 | 0.8473 | 0.6720 | 0.4983 | 0.5548 | 0.7997 | 0.9472 | 0.9817 | 0.9909 | (94) |
| Useful gains | 483.8606 | 521.4806 | 536.2692 | 561.6025 | 534.7565 | 423.9991 | 299.2278 | 309.7098 | 414.9943 | 454.1918 | 462.8792 | 469.6260 | (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 | 1180.8795 | 1143.1801 | 1034.0877 | 867.6167 | 672.7971 | 457.8532 | 305.9144 | 320.5226 | 491.7049 | 736.4428 | 977.5983 | 1179.0726 | (97) |
| Space heating kWh | 518.5821 | 417.7820 | 370.3769 | 220.3302 | 102.7022 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 209.9948 | 370.5978 | 527.8283 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 2738.1943 | |
| 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 | 518.5821 | 417.7820 | 370.3769 | 220.3302 | 102.7022 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 209.9948 | 370.5978 | 527.8283 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 2738.1943 | |
| Space heating per m2 | | | | | | | | | | | (98c) / (4) = | 31.7840 | (99) |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 732.1600 | 576.3813 | 591.1880 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.7950 | 0.8700 | 0.8329 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 582.0351 | 501.4595 | 492.3881 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 685.8205 | 652.8849 | 605.7329 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (103) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 74.7255 | 112.6605 | 84.3286 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |
| Cooled fraction | | | | | | | | | fC = cooled area / (4) = | | | 1.0000 | (105) |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | (106) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 18.6814 | 28.1651 | 21.0821 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (107) |
| Space cooling requirement | | | | | | | | | | | | 67.9286 | (107) |
| Energy for space heating | | | | | | | | | | | | 31.7840 | (99) |
| Energy for space cooling | | | | | | | | | | | | 0.7885 | (108) |
| Total | | | | | | | | | | | | 32.5725 | (109) |
| Fabric Energy Efficiency (DFEE) | | | | | | | | | | | | 32.6 | (109) |

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

## 1. Overall dwelling characteristics

| | Area (m2) | | Storey height (m) | | Volume (m3) | |
|---|---|---|---|---|---|---|
| Main dwelling | | | | | | |
| Ground floor | 86.1500 | (1b) | x 2.8000 | (2b) = | 241.2200 | (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 86.1500 | | | | | (4) |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 241.2200 | (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) = | 0.1244 | (8) |
| Pressure test | Yes | |
| Pressure Test Method | Blower Door | |
| Measured/design AP50 | 5.0000 | (17) |
| Infiltration rate | 0.3744 | (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) = | 0.3182 | (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 | 0.4057 | 0.3978 | 0.3898 | 0.3500 | 0.3421 | 0.3023 | 0.3023 | 0.2943 | 0.3182 | 0.3421 | 0.3580 | 0.3739 | (22b) |

| | | |
|---|---|---|
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.0000 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 0.0000 | (23c) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Effective ac | 0.5823 | 0.5791 | 0.5760 | 0.5613 | 0.5585 | 0.5457 | 0.5457 | 0.5433 | 0.5506 | 0.5585 | 0.5641 | 0.5699 | (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 | |
|---|---|---|---|---|---|---|---|---|
| Main dwelling | | | | | | | | |
| TER Opaque door | | | 2.4200 | 1.0000 | 2.4200 | | | (26) |
| TER Opening Type | | | 13.4500 | 1.1450 | 15.4008 | | | (27) |
| External Wall 1 | 54.8800 | 13.4500 | 41.4300 | 0.1800 | 7.4574 | | | (29a) |
| Corridor wall | 40.6600 | 2.4200 | 38.2400 | 0.1800 | 6.8832 | | | (29a) |
| Total net area of external elements Aum(A, m2) | | | 95.5400 | | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | (26)...(30) + (32) = | | 32.1614 | | | (33) |
| Main dwelling | | | | | | | | |
| Party Wall 1 | | | 27.8600 | 0.0000 | 0.0000 | | | (32) |

| | | |
|---|---|---|
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | 177.9973 | (35) |

List of Thermal Bridges

| K1 Element | Length | Psi-value | Total |
|---|---|---|---|
| E1 Steel lintel with perforated steel base plate | 8.4900 | 0.0500 | 0.4245 |
| E4 Jamb | 21.6000 | 0.0500 | 1.0800 |
| E7 Party floor between dwellings (in blocks of flats) | 30.4800 | 0.0700 | 2.1336 |
| E7 Party floor between dwellings (in blocks of flats) | 29.0400 | 0.0700 | 2.0328 |
| E9 Balcony between dwellings, wall insulation continuous | 8.7200 | 0.0200 | 0.1744 |
| E16 Corner (normal) | 5.6000 | 0.0900 | 0.5040 |
| E16 Corner (normal) | 5.6000 | 0.0900 | 0.5040 |
| E17 Corner (inverted - internal area greater than external area) | 2.8000 | -0.0900 | -0.2520 |
| E18 Party wall between dwellings | 2.8000 | 0.0600 | 0.1680 |
| E25 Staggered party wall between dwellings | 2.8000 | 0.0600 | 0.1680 |
| P3 Party wall - Intermediate floor between dwellings (in blocks of flats) | 19.9000 | 0.0000 | 0.0000 |
| E3 Sill | 4.9900 | 0.0500 | 0.2495 |

| | | |
|---|---|---|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | 7.1868 | (36) |
| Point Thermal bridges (36a) = | 0.0000 | |
| Total fabric heat loss (33) + (36) + (36a) = | 39.3482 | (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m | 46.3530 | 46.0986 | 45.8492 | 44.6779 | 44.4588 | 43.4386 | 43.4386 | 43.2497 | 43.8316 | 44.4588 | 44.9021 | 45.3656 | (38) |
| Heat transfer coeff | 85.7011 | 85.4467 | 85.1974 | 84.0261 | 83.8069 | 82.7868 | 82.7868 | 82.5978 | 83.1797 | 83.8069 | 84.2502 | 84.7137 | (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 84.0250 | |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLP | 0.9948 | 0.9918 | 0.9889 | 0.9753 | 0.9728 | 0.9610 | 0.9610 | 0.9588 | 0.9655 | 0.9728 | 0.9779 | 0.9833 | (40) |
| HLP (average) | | | | | | | | | | | | 0.9753 | |
| Days in mont | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | |

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

| | | |
|---|---|---|
| Assumed occupancy | 2.5693 | (42) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 29.0636 | 28.6319 | 28.0241 | 26.9034 | 26.0642 | 25.1336 | 24.6310 | 25.2346 | 25.8918 | 26.8875 | 28.0313 | 28.9653 | (42b) |
| Hot water usage for other uses | 40.9419 | 39.4531 | 37.9643 | 36.4755 | 34.9867 | 33.4979 | 33.4979 | 34.9867 | 36.4755 | 37.9643 | 39.4531 | 40.9419 | (42c) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 64.1664 | (43) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily hot water use | 70.0055 | 68.0851 | 65.9884 | 63.3789 | 61.0509 | 58.6316 | 58.1290 | 60.2213 | 62.3673 | 64.8518 | 67.4844 | 69.9072 | (44) |
| Energy conte | 110.8716 | 96.9522 | 101.4218 | 86.7625 | 82.1863 | 72.0944 | 70.3019 | 74.5666 | 76.9051 | 88.0033 | 96.1439 | 109.4578 | (45) |
| Energy content (annual) | | | | | | | | | | Total = Sum(45)m = | | 1065.6675 | |
| Distribution loss (46)m = 0.15 x (45)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 | (46) |
| Water storage loss (or HIU loss): | | | | | | | | | | | | | |
| Total storage loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (56) |
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) |
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (59) |
| Combi loss | 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 | 94.2408 | 82.4094 | 86.2085 | 73.7482 | 69.8583 | 61.2802 | 59.7566 | 63.3816 | 65.3694 | 74.8028 | 81.7223 | 93.0392 | (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 | 94.2408 | 82.4094 | 86.2085 | 73.7482 | 69.8583 | 61.2802 | 59.7566 | 63.3816 | 65.3694 | 74.8028 | 81.7223 | 93.0392 | (64) |
| | | | | | | | | Total per year (kWh/year) = Sum(64)m = | | | | 905.8174 | (64) |
| 12Total per year (kWh/year) | | | | | | | | | | | | 906 | (64) |
| Electric shower(s) | 53.8945 | 48.0204 | 52.4365 | 50.0395 | 50.9785 | 48.6285 | 50.2494 | 50.9785 | 50.0395 | 52.4365 | 51.4505 | 53.8945 | (64a) |
| | | | | | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | | | | | | | 613.0466 | (64a) |
| Heat gains from water heating, kWh/month | 37.0338 | 32.6075 | 34.6612 | 30.9469 | 30.2092 | 27.4772 | 27.5015 | 28.5900 | 28.8522 | 31.8098 | 33.2932 | 36.7334 | (65) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | | |
| (66)m | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | 128.4637 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| | 122.5838 | 135.7178 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | 122.5838 | 126.6699 | 122.5838 | 126.6699 | 122.5838 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| | 231.8138 | 234.2193 | 228.1576 | 215.2527 | 198.9627 | 183.6524 | 173.4241 | 171.0186 | 177.0804 | 189.9852 | 206.2753 | 221.5856 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | 35.8464 | (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) | | | | | | | | | | | | | |
| | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | -102.7709 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| | 49.7767 | 48.5230 | 46.5877 | 42.9818 | 40.6038 | 38.1627 | 36.9644 | 38.4274 | 40.0725 | 42.7551 | 46.2406 | 49.3729 | (72) |
| Total internal gains | | | | | | | | | | | | | |
| | 465.7134 | 479.9992 | 458.8681 | 446.4436 | 423.6894 | 410.0241 | 394.5114 | 393.5690 | 405.3620 | 416.8633 | 440.7249 | 455.0814 | (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 | |
|---|---|---|---|---|---|---|---|
| Northeast | 5.9600 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 20.5514 | (75) |
| Northwest | 7.4900 | 11.2829 | 0.6300 | 0.7000 | 0.7700 | 25.8271 | (81) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solar gains | 46.3785 | 94.4047 | 170.0873 | 279.3322 | 375.4773 | 400.2985 | 374.4710 | 298.5327 | 207.2540 | 115.3701 | 58.3561 | 37.8750 | (83) |
| Total gains | 512.0919 | 574.4039 | 628.9554 | 725.7758 | 799.1666 | 810.3226 | 768.9825 | 692.1016 | 612.6160 | 532.2333 | 499.0810 | 492.9564 | (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 | 49.7027 | 49.8506 | 49.9966 | 50.6935 | 50.8261 | 51.4524 | 51.4524 | 51.5700 | 51.2093 | 50.8261 | 50.5586 | 50.2820 | |
| alpha | 4.3135 | 4.3234 | 4.3331 | 4.3796 | 4.3884 | 4.4302 | 4.4302 | 4.4380 | 4.4140 | 4.3884 | 4.3706 | 4.3521 | |
| util living area | | | | | | | | | | | | | |
| | 0.9923 | 0.9865 | 0.9729 | 0.9219 | 0.8041 | 0.6156 | 0.4644 | 0.5310 | 0.7878 | 0.9519 | 0.9861 | 0.9935 | (86) |
| MIT | 19.4564 | 19.6460 | 19.9559 | 20.4158 | 20.7700 | 20.9477 | 20.9880 | 20.9790 | 20.8461 | 20.3864 | 19.8598 | 19.4346 | (87) |
| Th 2 | 20.0877 | 20.0901 | 20.0926 | 20.1039 | 20.1061 | 20.1160 | 20.1160 | 20.1178 | 20.1122 | 20.1061 | 20.1018 | 20.0972 | (88) |
| util rest of house | | | | | | | | | | | | | |
| | 0.9905 | 0.9834 | 0.9663 | 0.9027 | 0.7597 | 0.5433 | 0.3753 | 0.4369 | 0.7245 | 0.9362 | 0.9822 | 0.9920 | (89) |
| MIT 2 | 18.6732 | 18.8632 | 19.1709 | 19.6229 | 19.9424 | 20.0883 | 20.1118 | 20.1099 | 20.0174 | 19.6043 | 19.0855 | 18.6588 | (90) |
| Living area fraction | | | | | | | | | fLA = Living area / (4) = | | | 0.4500 | (91) |
| MIT | 19.0257 | 19.2155 | 19.5242 | 19.9797 | 20.3148 | 20.4750 | 20.5061 | 20.5010 | 20.3904 | 19.9563 | 19.4340 | 19.0079 | (92) |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | |
| adjusted MIT | 19.0257 | 19.2155 | 19.5242 | 19.9797 | 20.3148 | 20.4750 | 20.5061 | 20.5010 | 20.3904 | 19.9563 | 19.4340 | 19.0079 | (93) |

## 8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation | 0.9878 | 0.9794 | 0.9611 | 0.8996 | 0.7709 | 0.5736 | 0.4152 | 0.4787 | 0.7459 | 0.9330 | 0.9785 | 0.9895 | (94) |
| Useful gains | 505.8221 | 562.5907 | 604.4934 | 652.9352 | 616.0431 | 464.7620 | 319.3023 | 331.3267 | 456.9561 | 496.5956 | 488.3549 | 487.7855 | (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 | | | | | | | | | | | | | |
| | 1262.0065 | 1223.2149 | 1109.6259 | 930.9869 | 721.9832 | 486.3760 | 323.3765 | 338.7361 | 523.2309 | 784.1214 | 1039.1387 | 1254.4346 | (97) |
| Space heating kWh | | | | | | | | | | | | | |
| | 562.6012 | 443.9394 | 375.8186 | 200.1972 | 78.8194 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 213.9192 | 396.5643 | 570.3869 | (98a) |
| Space heating requirement - total per year (kWh/year) | | | | | | | | | | | | 2842.2463 | |
| 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 | | | | | | | | | | | | | |
| | 562.6012 | 443.9394 | 375.8186 | 200.1972 | 78.8194 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 213.9192 | 396.5643 | 570.3869 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | | | | | | | | | | | | 2842.2463 | |
| Space heating per m2 | | | | | | | | | | | (98c) / (4) = | 32.9918 | (99) |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | |
| Heat loss rate W | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 778.1956 | 612.6221 | 627.7436 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8681 | 0.9211 | 0.8856 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 675.5342 | 564.2824 | 555.9226 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 895.2481 | 849.4596 | 762.0481 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (103) |
| Space cooling kWh | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 158.1940 | 212.1718 | 153.3573 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (104) |
| Cooled fraction | | | | | | | | | fC = cooled area / (4) = | | | 1.0000 | (105) |
| Intermittency factor (Table 10b) | | | | | | | | | | | | | |
| | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | (106) |
| Space cooling kWh | | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 39.5485 | 53.0429 | 38.3393 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (107) |
| Space cooling requirement | | | | | | | | | | | | 130.9308 | (107) |
| Energy for space heating | | | | | | | | | | | | 32.9918 | (99) |
| Energy for space cooling | | | | | | | | | | | | 1.5198 | (108) |
| Total | | | | | | | | | | | | 34.5116 | (109) |
| Fabric Energy Efficiency (TFEE) | | | | | | | | | | | | 34.5 | (109) |