# 13.0 APPENDIX 2 – EXAMPLE DER WORKSHEET

## DER WorkSheet: New dwelling design stage

**User Details:**

**Assessor Name:** **Stroma Number:**
**Software Name:** Stroma FSAP 2009 **Software Version:** Version: 1.5.0.76

**Property Address: Type 1**

**Address :**

**1. Overall dwelling dimensions:**

| | Area(m²) | | Ave Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 70 | (1a) x | 2.7 | (2a) = | 189 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 70 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 189 | (5) |

**2. Ventilation rate:**

| | main heating | | Secondary heating | | other | | total | | m³ per hour | |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of chimneys | 0 | + | 0 | + | 0 | = | 0 | x 40 = | 0 | (6a) |
| Number of open flues | 0 | + | 0 | + | 0 | = | 0 | x 20 = | 0 | (6b) |
| Number of intermittent fans | | | | | | | 0 | x 10 = | 0 | (7a) |
| Number of passive vents | | | | | | | 0 | x 10 = | 0 | (7b) |
| Number of flueless gas fires | | | | | | | 0 | x 40 = | 0 | (7c) |

| | | Air changes per hour | |
|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 ÷ (5) = | 0 (8) |
| *If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)* | | | |
| Number of storeys in the dwelling (ns) | | | 0 (9) |
| Additional infiltration | | [(9)-1]x0.1 = | 0 (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | | 0 (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | | 0 (12) |
| If no draught lobby, enter 0.05, else enter 0 | | | 0 (13) |
| Percentage of windows and doors draught stripped | | | 0 (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | | 0 (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | | 0 (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | | 3 (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | | 0.15 (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides on which sheltered | | | 2 (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | | 0.85 (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | | 0.13 (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.4 | 5.1 | 5.1 | 4.5 | 4.1 | 3.9 | 3.7 | 3.7 | 4.2 | 4.5 | 4.8 | 5.1 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.35 | 1.27 | 1.27 | 1.12 | 1.02 | 0.98 | 0.92 | 0.92 | 1.05 | 1.12 | 1.2 | 1.27 |



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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.17 | 0.16 | 0.16 | 0.14 | 0.13 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 63.75 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.35 | 0.34 | 0.34 | 0.32 | 0.31 | 0.31 | 0.3 | 0.3 | 0.32 | 0.32 | 0.33 | 0.34 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.35 | 0.34 | 0.34 | 0.32 | 0.31 | 0.31 | 0.3 | 0.3 | 0.32 | 0.32 | 0.33 | 0.34 | (25) |

**3. Heat losses and heat loss parameter:**

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | U-value W/m2K | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|
| Windows Type 1 | | | 6 | x1/[1/( 1.2 )+ 0.04] = | 6.87 | | | (27) |
| Windows Type 2 | | | 4.5 | x1/[1/( 1.2 )+ 0.04] = | 5.15 | | | (27) |
| Windows Type 3 | | | 7.75 | x1/[1/( 1.2 )+ 0.04] = | 8.87 | | | (27) |
| Windows Type 4 | | | 5 | x1/[1/( 1.2 )+ 0.04] = | 5.73 | | | (27) |
| Walls Type1 | 22.95 | 9.5 | 13.45 | x 0.15 = | 2.02 | | | (29) |
| Walls Type2 | 23.76 | 13.75 | 10.01 | x 0.15 = | 1.5 | | | (29) |
| Total area of elements, m² | | | 46.71 | | | | | (31) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)...(30) + (32) = | 30.14 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)...(30) + (32) + (32a)...(32e) = | 4457.4002 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | Indicative Value: Medium | 250 | (35) |
| *For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.* | | | |
| Thermal bridges : S (L x Y) calculated using Appendix K | | 1.87 | (36) |
| *if details of thermal bridging are not known (36) = 0.15 x (31)* | | | |
| Total fabric heat loss | (33) + (36) = | 32.01 | (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 22.04 | 21.44 | 21.44 | 20.25 | 19.46 | 19.06 | 18.66 | 18.66 | 19.65 | 20.25 | 20.85 | 21.44 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 54.05 | 53.45 | 53.45 | 52.26 | 51.47 | 51.07 | 50.67 | 50.67 | 51.66 | 52.26 | 52.86 | 53.45 | |

Average = Sum(39)...(39) /12= 52.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.77 | 0.76 | 0.76 | 0.75 | 0.74 | 0.73 | 0.72 | 0.72 | 0.74 | 0.75 | 0.76 | 0.76 |

Average = Sum(40)$_{1..12}$ /12= 0.75 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

(41)

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.55 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 96.3 | 92.8 | 89.3 | 85.79 | 82.29 | 78.79 | 78.79 | 82.29 | 85.79 | 89.3 | 92.8 | 96.3 |

Total = Sum(44)$_{1..12}$ = 1050.55 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 143.15 | 125.2 | 129.2 | 112.64 | 108.08 | 93.26 | 86.42 | 99.17 | 100.35 | 116.95 | 127.66 | 138.63 |

Total = Sum(45)$_{1..12}$ = 1380.73 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.47 | 18.78 | 19.38 | 16.9 | 16.21 | 13.99 | 12.96 | 14.88 | 15.05 | 17.54 | 19.15 | 20.8 |

Water storage loss:
a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)
Temperature factor from Table 2b 0 (48)
Energy lost from water storage, kWh/year (47) x (48) = 0 (49)
If manufacturer's declared cylinder loss factor is not known:
Cylinder volume (litres) including any solar storage within same 110 (50)
*If community heating and no tank in dwelling, enter 110 litres in box (50)*
*Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)*
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)
Volume factor from Table 2a 1.03 (52)
Temperature factor from Table 2b 0.6 (53)
Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 1.03 (54)
Enter (49) or (54) in (55) 1.03 (55)
Water storage loss calculated for each month (56)m = (55) × (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 |

Primary circuit loss (annual) from Table 3 360 (58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 30.58 | 27.62 | 30.58 | 29.59 | 30.58 | 29.59 | 30.58 | 30.58 | 29.59 | 30.58 | 29.59 | 30.58 |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |





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Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 205.74 | 181.73 | 191.79 | 173.21 | 170.67 | 153.83 | 149.01 | 161.76 | 160.93 | 179.54 | 188.23 | 201.22 |

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

(63)

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 205.74 | 181.73 | 191.79 | 173.21 | 170.67 | 153.83 | 149.01 | 161.76 | 160.93 | 179.54 | 188.23 | 201.22 |

Output from water heater (annual)$_{1..12}$ 2117.67 (64)

Heat gains from water heating, kWh/month 0.25 x [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 97.67 | 86.86 | 93.03 | 85.91 | 86.01 | 79.47 | 78.81 | 83.05 | 81.82 | 88.96 | 90.9 | 96.17 |

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 | 112.31 |

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 17.59 | 15.62 | 12.71 | 9.62 | 7.19 | 6.07 | 6.56 | 8.53 | 11.44 | 14.53 | 16.96 | 18.08 |

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 197.3 | 199.34 | 194.19 | 183.2 | 169.34 | 156.31 | 147.6 | 145.55 | 150.71 | 161.7 | 175.56 | 188.59 |

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 | 34.23 |

(69)

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

(70)

Losses e.g. evaporation (negative values) (Table 5)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 | -89.84 |

(71)

Water heating gains (Table 5)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 131.28 | 129.25 | 125.04 | 119.32 | 115.6 | 110.37 | 105.92 | 111.62 | 113.65 | 119.57 | 126.26 | 129.26 |

(72)

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 402.85 | 400.91 | 388.62 | 368.83 | 348.82 | 329.44 | 316.78 | 322.39 | 332.49 | 352.49 | 375.47 | 392.62 |

(73)

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast 0.9x | 0.77 | x | 6 | x | 11.51 | x | 0.57 | x | 0.7 | = | 19.1 | (75) |
| Northeast 0.9x | 0.77 | x | 7.75 | x | 11.51 | x | 0.57 | x | 0.7 | = | 24.66 | (75) |
| Northeast 0.9x | 0.77 | x | 6 | x | 23.55 | x | 0.57 | x | 0.7 | = | 39.08 | (75) |
| Northeast 0.9x | 0.77 | x | 7.75 | x | 23.55 | x | 0.57 | x | 0.7 | = | 50.48 | (75) |
| Northeast 0.9x | 0.77 | x | 6 | x | 41.13 | x | 0.57 | x | 0.7 | = | 68.23 | (75) |
| Northeast 0.9x | 0.77 | x | 7.75 | x | 41.13 | x | 0.57 | x | 0.7 | = | 88.13 | (75) |
| Northeast 0.9x | 0.77 | x | 6 | x | 67.8 | x | 0.57 | x | 0.7 | = | 112.48 | (75) |
| Northeast 0.9x | 0.77 | x | 7.75 | x | 67.8 | x | 0.57 | x | 0.7 | = | 145.29 | (75) |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 0.9x | 0.77 | x | 6 | x | 89.77 | x | 0.57 | x | 0.7 | = | 148.93 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 89.77 | x | 0.57 | x | 0.7 | = | 192.36 | (75) |
| Northeast | 0.9x | 0.77 | x | 6 | x | 97.5 | x | 0.57 | x | 0.7 | = | 161.76 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 97.5 | x | 0.57 | x | 0.7 | = | 208.94 | (75) |
| Northeast | 0.9x | 0.77 | x | 6 | x | 92.98 | x | 0.57 | x | 0.7 | = | 154.26 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 92.98 | x | 0.57 | x | 0.7 | = | 199.25 | (75) |
| Northeast | 0.9x | 0.77 | x | 6 | x | 75.42 | x | 0.57 | x | 0.7 | = | 125.12 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 75.42 | x | 0.57 | x | 0.7 | = | 161.61 | (75) |
| Northeast | 0.9x | 0.77 | x | 6 | x | 51.24 | x | 0.57 | x | 0.7 | = | 85.02 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 51.24 | x | 0.57 | x | 0.7 | = | 109.81 | (75) |
| Northeast | 0.9x | 0.77 | x | 6 | x | 29.6 | x | 0.57 | x | 0.7 | = | 49.11 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 29.6 | x | 0.57 | x | 0.7 | = | 63.43 | (75) |
| Northeast | 0.9x | 0.77 | x | 6 | x | 14.52 | x | 0.57 | x | 0.7 | = | 24.1 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 14.52 | x | 0.57 | x | 0.7 | = | 31.13 | (75) |
| Northeast | 0.9x | 0.77 | x | 6 | x | 9.36 | x | 0.57 | x | 0.7 | = | 15.53 | (75) |
| Northeast | 0.9x | 0.77 | x | 7.75 | x | 9.36 | x | 0.57 | x | 0.7 | = | 20.06 | (75) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 37.39 | x | 0.57 | x | 0.7 | = | 46.52 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 37.39 | x | 0.57 | x | 0.7 | = | 51.69 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 63.74 | x | 0.57 | x | 0.7 | = | 79.3 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 63.74 | x | 0.57 | x | 0.7 | = | 88.12 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 84.22 | x | 0.57 | x | 0.7 | = | 104.79 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 84.22 | x | 0.57 | x | 0.7 | = | 116.43 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 103.49 | x | 0.57 | x | 0.7 | = | 128.77 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 103.49 | x | 0.57 | x | 0.7 | = | 143.08 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 113.34 | x | 0.57 | x | 0.7 | = | 141.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 113.34 | x | 0.57 | x | 0.7 | = | 156.69 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 115.04 | x | 0.57 | x | 0.7 | = | 143.15 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 115.04 | x | 0.57 | x | 0.7 | = | 159.05 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 112.79 | x | 0.57 | x | 0.7 | = | 140.34 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 112.79 | x | 0.57 | x | 0.7 | = | 155.94 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 105.34 | x | 0.57 | x | 0.7 | = | 131.07 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 105.34 | x | 0.57 | x | 0.7 | = | 145.64 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 92.9 | x | 0.57 | x | 0.7 | = | 115.59 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 92.9 | x | 0.57 | x | 0.7 | = | 128.43 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 72.36 | x | 0.57 | x | 0.7 | = | 90.04 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 72.36 | x | 0.57 | x | 0.7 | = | 100.04 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 44.83 | x | 0.57 | x | 0.7 | = | 55.78 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 44.83 | x | 0.57 | x | 0.7 | = | 61.97 | (77) |
| Southeast | 0.9x | 0.77 | x | 4.5 | x | 31.95 | x | 0.57 | x | 0.7 | = | 39.75 | (77) |
| Southeast | 0.9x | 0.77 | x | 5 | x | 31.95 | x | 0.57 | x | 0.7 | = | 44.17 | (77) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 141.97 | 256.97 | 377.58 | 529.61 | 639 | 672.9 | 649.79 | 563.45 | 438.85 | 302.62 | 172.97 | 119.51 |

(83)



DER WorkSheet: New dwelling design stage

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 544.83 | 657.88 | 766.2 | 898.44 | 987.82 | 1002.34 | 966.56 | 885.84 | 771.35 | 655.1 | 548.44 | 512.13 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.99 | 0.96 | 0.87 | 0.7 | 0.48 | 0.33 | 0.21 | 0.23 | 0.45 | 0.77 | 0.97 | 0.99 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.49 | 20.68 | 20.87 | 20.97 | 21 | 21 | 21 | 21 | 21 | 20.96 | 20.7 | 20.49 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.28 | 20.29 | 20.29 | 20.3 | 20.31 | 20.32 | 20.32 | 20.32 | 20.31 | 20.3 | 20.29 | 20.29 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.98 | 0.95 | 0.85 | 0.66 | 0.45 | 0.29 | 0.18 | 0.2 | 0.4 | 0.73 | 0.96 | 0.99 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.61 | 19.88 | 20.14 | 20.28 | 20.31 | 20.32 | 20.32 | 20.32 | 20.31 | 20.26 | 19.92 | 19.62 | (90) |

fLA = Living area ÷ (4) = 0.26 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.84 | 20.09 | 20.33 | 20.46 | 20.49 | 20.49 | 20.5 | 20.5 | 20.49 | 20.44 | 20.12 | 19.84 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.84 | 20.09 | 20.33 | 20.46 | 20.49 | 20.49 | 20.5 | 20.5 | 20.49 | 20.44 | 20.12 | 19.84 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

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

Utilisation factor for gains, hm:

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (94)m= | 0.98 | 0.95 | 0.85 | 0.67 | 0.46 | 0.3 | 0.19 | 0.21 | 0.41 | 0.74 | 0.95 | 0.98 | (94) |

Useful gains, hmGm , W = (94)m x (84)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (95)m= | 534.57 | 622.2 | 650.63 | 601.3 | 451.52 | 300.99 | 182.32 | 182.32 | 319.41 | 484.11 | 523.17 | 503.95 | (95) |

Monthly average external temperature from Table 8

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (96)m= | 4.5 | 5 | 6.8 | 8.7 | 11.7 | 14.6 | 16.9 | 16.9 | 14.3 | 10.8 | 7 | 4.9 | (96) |

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 829.12 | 806.44 | 723.05 | 614.48 | 452.34 | 301.02 | 182.32 | 182.32 | 319.72 | 504.03 | 693.51 | 798.79 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 219.15 | 123.81 | 53.89 | 9.49 | 0.61 | 0 | 0 | 0 | 0 | 14.82 | 122.64 | 219.36 | |

Total per year (kWh/year) = Sum(98)$_{1..5,9..12}$ = 763.77 (98)

Space heating requirement in kWh/m²/year 10.91 (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 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (100)m= | 0 | 0 | 0 | 0 | 0 | 449.39 | 324.29 | 314.15 | 0 | 0 | 0 | 0 | (100) |

Utilisation factor for loss hm

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (101)m= | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | (101) |

Useful loss, hmLm (Watts) = (100)m x (101)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (102)m= | 0 | 0 | 0 | 0 | 0 | 449.29 | 324.28 | 314.14 | 0 | 0 | 0 | 0 | (102) |

Gains (solar gains calculated for applicable weather region, see Table 10)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (103)m= | 0 | 0 | 0 | 0 | 0 | 1337.42 | 1271.96 | 1183.74 | 0 | 0 | 0 | 0 | (103) |

*Space cooling requirement for month, whole dwelling, continuous ( kWh) = 0.024 x [(103)m – (102)m ] x (41)m*
set (104)m to zero if (104)m < 3 × (98)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (104)m= | 0 | 0 | 0 | 0 | 0 | 639.45 | 705.07 | 646.98 | 0 | 0 | 0 | 0 | |

Total = Sum(104) = 1991.5 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.55 (105)

Intermittency factor (Table 10b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (106)m= | 0 | 0 | 0 | 0 | 0 | 0.25 | 0.25 | 0.25 | 0 | 0 | 0 | 0 | |

*Total = Sum(104)* = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (107)m= | 0 | 0 | 0 | 0 | 0 | 88.61 | 97.7 | 89.65 | 0 | 0 | 0 | 0 | |

Total = Sum(107) = 275.96 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 3.94 (108)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none: 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

Fraction of heat from Community heat pump: 1 (303a)

Fraction of heat from Community heat pump (Water): 0.2 (303a)

Fraction of community heat from heat source 2 (Water): 0.8 (303b)

Fraction of total space heat from Community heat pump — (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system: 1 (305)

Distribution loss factor (Table 12c) for community heating system: 1.05 (306)

Distribution loss factor (Table 12c) for community heating system (Water): 1.05 (306)

| **Space heating** | | **kWh/year** | |
|---|---|---|---|
| Annual space heating requirement | | 763.77 | |
| Space heat from Community heat pump | (98) x (304a) x (305) x (306) = | 801.96 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2117.67 | |
| If DHW from community scheme: Water heat from CHP (Water) | (64) x (303a) x (305) x (306) = | 444.71 | (310a) |
| Water heat from heat source 2 (Water) | (64) x (303a) x (305) x (306) = | 1778.84 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 8.02 | (313) |





| | | | |
|---|---|---|---|
| Electricity used for heat distribution (Water) | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 22.24 | (313) |
| Cooling System Energy Efficiency Ratio | | 5.4 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 51.1 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 155.64 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 155.64 | (331) |
| Energy for lighting (calculated in Appendix L) | | 310.63 | (332) |

## 12b. CO2 Emissions – Community heating scheme

| | | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | | **Emissions kg CO2/year** | |
|---|---|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | | 400 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | | | 0 | = | 103.65 | (367) |
| Electrical energy for heat distribution | [(313) x | | | | 0.52 | = | 4.15 | (372) |
| Water heating from separate community system | | | | | | | | |
| Electrical efficiency of CHP unit | | | | | | | 24.57 | (361) |
| Heat efficiency of CHP unit | | | | | | | 61.43 | (362) |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | | 0 | x | 0 | | 0 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | | 0 | x | 0 | | 0 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | | 723.95 | x | 0.2 | | 143.34 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | | 177.88 | x | 0.53 | | -94.1 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | | 96 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | | 0.2 | = | 366.89 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | 0.52 | = | 11.5 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | | = | 535.42 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | | 0.2 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | | 535.42 | (376) |
| CO2 associated with space cooling | (315) x | | | | 0.52 | = | 26.42 | (377) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | | 0.52 | = | 80.47 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | | 0.52 | = | 160.6 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | | 802.91 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | | 11.47 | (384) |
| **EI rating (section 14)** | | | | | | | 90.64 | (385) |

# 14.0 APPENDIX 3 – COMMUNAL AREAS BER

## BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

**Project name**

**Name** As designed

**Date:** Mon Aug 11 10:41:28 2014

### Administrative information

**Building Details**

**Address:** Address 1, City, Postcode

**Certification tool**

**Calculation engine:** Apache

**Calculation engine version:** 6.4.0.13

**Interface to calculation engine:** IES Virtual Environment

**Interface to calculation engine version:** 6.4.0.13

**BRUKL compliance check version:** v4.1.e.5

**Owner Details**

**Name:** Name

**Telephone number:** Phone

**Address:** Street Address, City, Postcode

**Certifier details**

**Name:** Name

**Telephone number:** Phone

**Address:** Street Address, City, Postcode

### Criterion 1: The calculated $CO_2$ emission rate for the building should not exceed the target

| | | |
|---|---|---|
| 1.1 | $CO_2$ emission rate from the notional building, $kgCO_2/m^2.annum$ | 24.3 |
| 1.2 | Target $CO_2$ emission rate (TER), $kgCO_2/m^2.annum$ | 24.3 |
| 1.3 | Building $CO_2$ emission rate (BER), $kgCO_2/m^2.annum$ | 16 |
| 1.4 | Are emissions from the building less than or equal to the target? | BER =< TER |
| 1.5 | Are as built details the same as used in the BER calculations? | Separate submission |

### Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

**2.a Building fabric**

| Element | $U_{a\text{-}Limit}$ | $U_{a\text{-}Calc}$ | $U_{i\text{-}Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.15 | 0.15 | 0900001A:Surf[1] |
| Floor | 0.25 | 0.11 | 0.11 | 098C0001:Surf[0] |
| Roof | 0.25 | 0.11 | 0.11 | 098C0001:Surf[1] |
| Windows***, roof windows, and rooflights | 2.2 | 1.21 | 1.21 | 099B0001:Surf[0] |
| Personnel doors | 2.2 | - | - | No Personnel doors in building |
| Vehicle access & similar large doors | 1.5 | - | - | No Vehicle access doors in building |
| High usage entrance doors | 3.5 | - | - | No High usage entrance doors in building |

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values $[W/(m^2K)]$

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values $[W/(m^2K)]$

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values $[W/(m^2K)]$

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air Permeability | Worst acceptable standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 3 |



**2.b Building services**

**The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.**

| | |
|---|---|
| **Whole building lighting automatic monitoring & targeting with alarms for out-of-range values** | YES |
| **Whole building electric power factor achieved by power factor correction** | <0.9 |

1- VRF Heating Cooling MVHR

| Heating seasonal efficiency | Cooling nominal efficiency | SFP [W/(l/s)] | HR seasonal efficiency |
|---|---|---|---|
| 4 | 3.64 | 0 | 0.7 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | YES |

1- DHW

| Heating seasonal efficiency | Hot water storage loss factor [kWh/litre per day] |
|---|---|
| 2 | 0.001 |

**Local mechanical ventilation and exhaust**

| Zone | Supply/extract SFP [W/(l/s)] | HR seasonal efficiency | Exhaust SFP [W/(l/s)] |
|---|---|---|---|
| 098: Corridor | 0.8 | - | - |
| 098: Corridor | 0.8 | - | - |
| 098: Corridor | 0.8 | - | - |
| 098: Corridor | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Plant | 0.8 | - | - |
| 098: Stairs | 0.8 | - | - |
| 098: Storage | 0.8 | - | - |
| 099: A ? Common Room | 0.8 | - | - |
| 099: A Common Room | 0.8 | - | - |
| 099: A Corridor | 0.8 | - | - |
| 099: A Corridor 2 | 0.8 | - | - |
| 099: A Corridor 3 | 0.8 | - | - |
| 099: A Corridor 3 | 0.8 | - | - |
| 099: A Plant | 0.8 | - | - |
| 099: A Stairs | 0.8 | - | - |
| 099: A WC | 0.8 | - | - |
| 099: B Common Room | 0.8 | - | - |
| 099: B Corridor | 0.8 | - | - |
| 099: B Plant | 0.8 | - | - |
| 099: B Stairs | 0.8 | - | - |
| 099: B Stairs | 0.8 | - | - |
| 099: B Storage | 0.8 | - | - |
| 099: C Art Room | 0.8 | - | - |
| 099: C Bike Store | 0.8 | - | - |
| 099: C Corridor | 0.8 | - | - |
| 099: C Storage | 0.8 | - | - |
| 100: A Corridor | 0.8 | - | - |

**Local mechanical ventilation and exhaust**

| Zone | Supply/extract SFP [W/(l/s)] | HR seasonal efficiency | Exhaust SFP [W/(l/s)] |
|---|---|---|---|
| 100: A Kitchen | 0.8 | - | - |
| 100: A Stairs | 0.8 | - | - |
| 100: A WC | 0.8 | - | - |
| 100: A Well Being Cafe Extension | 0.8 | - | - |
| 100: B Common Room | 0.8 | - | - |
| 100: B Corridor | 0.8 | - | - |
| 100: B Corridor | 0.8 | - | - |
| 100: B Office | 0.8 | - | - |
| 100: B Office | 0.8 | - | - |
| 100: B Stairs | 0.8 | - | - |
| 100: B Stairs | 0.8 | - | - |
| 100: B WC | 0.8 | - | - |
| 101: B Stairs | 0.8 | - | - |
| 103: B Stairs | 0.8 | - | - |
| 102: B Stairs | 0.8 | - | - |
| 104: B Stairs | 0.8 | - | - |
| 105: B Stairs | 0.8 | - | - |
| 105: C Corridor | 0.8 | - | - |
| 106: B Corridor | 0.8 | - | - |
| 106: B Corridor | 0.8 | - | - |
| 106: B Stairs | 0.8 | - | - |
| 107: B Corridor | 0.8 | - | - |
| 107: B Corridor | 0.8 | - | - |
| 107: B Stairs | 0.8 | - | - |
| 109: B Corridor | 0.8 | - | - |
| 109: B Corridor | 0.8 | - | - |
| 109: B Stairs | 0.8 | - | - |
| 108: B Corridor | 0.8 | - | - |
| 108: B Corridor | 0.8 | - | - |
| 108: B Stairs | 0.8 | - | - |

**General lighting and display lighting**

| Zone | General lighting [W] | Display lamps efficacy [lm/W] |
|---|---|---|
| 098: Car Park | 770 | - |
| 098: Corridor | 90 | - |
| 098: Corridor | 20 | - |
| 098: Corridor | 70 | - |
| 098: Corridor | 30 | - |
| 098: Plant | 260 | - |
| 098: Plant | 310 | - |
| 098: Plant | 100 | - |
| 098: Plant | 300 | - |
| 098: Plant | 490 | - |
| 098: Plant | 360 | - |
| 098: Plant | 270 | - |
| 098: Stairs | 40 | - |
| 098: Storage | 50 | - |



**General lighting and display lighting**

| Zone | General lighting [W] | Display lamps efficacy [lm/W] |
|---|---|---|
| 099: A ? Common Room | 120 | 15 |
| 099: A Common Room | 100 | 15 |
| 099: A Corridor | 20 | - |
| 099: A Corridor 2 | 50 | - |
| 099: A Corridor 3 | 40 | - |
| 099: A Corridor 3 | 70 | - |
| 099: A Plant | 260 | - |
| 099: A Stairs | 40 | - |
| 099: A Swimming Pool | 850 | - |
| 099: A WC | 80 | - |
| 099: B Common Room | 180 | 15 |
| 099: B Common Room | 180 | 15 |
| 099: B Corridor | 30 | - |
| 099: B Corridor 1 | 50 | - |
| 099: B Corridor 2 | 50 | - |
| 099: B Plant | 130 | - |
| 099: B Stairs | 30 | - |
| 099: B Stairs | 40 | - |
| 099: B Storage | 40 | - |
| 099: C Art Room | 240 | 15 |
| 099: C Bike Store | 50 | - |
| 099: C Corridor | 40 | - |
| 099: C Storage | 60 | - |
| 099: D Corridor | 80 | - |
| 099: D Stairs | 50 | - |
| 099: Well Being Centre | 230 | - |
| 100: A Corridor | 20 | - |
| 100: A Kitchen | 220 | - |
| 100: A Stairs | 40 | - |
| 100: A WC | 80 | - |
| 100: A Well Being Cafe | 370 | 15 |
| 100: A Well Being Cafe Extension | 140 | 15 |
| 100: B Common Room | 0 | 15 |
| 100: B Corridor | 50 | - |
| 100: B Corridor | 30 | - |
| 100: B Lobby | 310 | 15 |
| 100: B Office | 300 | - |
| 100: B Office | 190 | - |
| 100: B Stairs | 40 | - |
| 100: B Stairs | 30 | - |
| 100: B WC | 60 | - |
| 100: C Corridor 1 | 70 | - |
| 100: C Corridor 2 | 40 | - |
| 100: D Corridor | 80 | - |
| 100: D Stairs | 50 | - |
| 101: A Corridor | 60 | - |
| 101: A Double Height | 20 | - |

**General lighting and display lighting**

| Zone | General lighting [W] | Display lamps efficacy [lm/W] |
|---|---|---|
| 101: B Corridor 1 | 80 | - |
| 101: B Corridor 2 | 40 | - |
| 101: B Stairs | 40 | - |
| 101: C Corridor 1 | 60 | - |
| 101: C Corridor 2 | 40 | - |
| 101: D Corridor | 80 | - |
| 101: D Stairs | 40 | - |
| 102: A Corridor | 60 | - |
| 102: A Double Height | 0 | - |
| 102: B Corridor 1 | 80 | - |
| 102: B Corridor 2 | 40 | - |
| 103: B Stairs | 40 | - |
| 102: B Stairs | 40 | - |
| 102: C Corridor 1 | 60 | - |
| 102: C Corridor 2 | 40 | - |
| 102: D Corridor | 80 | - |
| 102: D Stairs | 40 | - |
| 103: A Double Height | 20 | - |
| 103: B Corridor 1 | 80 | - |
| 103: B Corridor 2 | 40 | - |
| 103: C Corridor | 70 | - |
| 103: C Corridor | 60 | - |
| 104 : B Corridor 1 | 80 | - |
| 104 : B Corridor 2 | 40 | - |
| 104 : C Corridor | 80 | - |
| 105: B Corridor 1 | 80 | - |
| 105: B Corridor 2 | 40 | - |
| 104: B Stairs | 40 | - |
| 105: B Stairs | 40 | - |
| 105: C Corridor | 80 | - |
| 106: B Corridor | 80 | - |
| 106: B Corridor | 40 | - |
| 106: B Stairs | 40 | - |
| 107: B Corridor | 80 | - |
| 107: B Corridor | 40 | - |
| 107: B Stairs | 40 | - |
| 109: B Corridor | 80 | - |
| 109: B Corridor | 40 | - |
| 109: B Stairs | 40 | - |
| 108: B Corridor | 80 | - |
| 108: B Corridor | 40 | - |
| 108: B Stairs | 40 | - |



**Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains**

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| 098: Car Park | N/A | N/A |
| 098: Corridor | N/A | N/A |
| 098: Corridor | N/A | N/A |
| 098: Corridor | N/A | N/A |
| 098: Corridor | N/A | N/A |
| 098: Plant | N/A | N/A |
| 098: Plant | N/A | N/A |
| 098: Plant | N/A | N/A |
| 098: Plant | N/A | N/A |
| 098: Plant | N/A | N/A |
| 098: Plant | N/A | N/A |
| 098: Plant | N/A | N/A |
| 098: Stairs | N/A | N/A |
| 098: Storage | N/A | N/A |
| 099: A ? Common Room | N/A | N/A |
| 099: A Common Room | N/A | N/A |
| 099: A Corridor | N/A | N/A |
| 099: A Corridor 2 | N/A | N/A |
| 099: A Corridor 3 | N/A | N/A |
| 099: A Corridor 3 | N/A | N/A |
| 099: A Plant | N/A | N/A |
| 099: A Stairs | N/A | N/A |
| 099: A Swimming Pool | N/A | N/A |
| 099: A WC | N/A | N/A |
| 099: B Common Room | NO (-60.7%) | NO |
| 099: B Common Room | NO (-91.1%) | NO |
| 099: B Corridor | N/A | N/A |
| 099: B Corridor 1 | N/A | N/A |
| 099: B Corridor 2 | N/A | N/A |
| 099: B Plant | N/A | N/A |
| 099: B Stairs | N/A | N/A |
| 099: B Stairs | N/A | N/A |
| 099: B Storage | N/A | N/A |
| 099: C Art Room | NO (-58.5%) | NO |
| 099: C Bike Store | N/A | N/A |
| 099: C Corridor | NO (-99.5%) | NO |
| 099: C Storage | N/A | N/A |
| 099: D Corridor | NO (-15%) | NO |
| 099: D Stairs | NO (-72.3%) | NO |
| 099: Well Being Centre | NO (-40.5%) | NO |
| 100: A Corridor | N/A | N/A |
| 100: A Kitchen | N/A | N/A |
| 100: A Stairs | N/A | N/A |
| 100: A WC | N/A | N/A |

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| 100: A Well Being Cafe | NO (-56.3%) | NO |
| 100: A Well Being Cafe Extension | NO (-92.8%) | NO |
| 100: B Common Room | NO (-72.7%) | NO |
| 100: B Corridor | NO (-55.2%) | NO |
| 100: B Corridor | NO (-76.9%) | NO |
| 100: B Lobby | NO (-62.1%) | NO |
| 100: B Office | NO (-71.4%) | NO |
| 100: B Office | NO (-69.1%) | NO |
| 100: B Stairs | N/A | N/A |
| 100: B Stairs | N/A | N/A |
| 100: B WC | N/A | N/A |
| 100: C Corridor 1 | N/A | N/A |
| 100: C Corridor 2 | NO (-57.5%) | NO |
| 100: D Corridor | NO (-14.4%) | NO |
| 100: D Stairs | NO (-70.4%) | NO |
| 101: A Corridor | NO (-100%) | NO |
| 101: A Double Height | NO (-36.5%) | NO |
| 101: B Corridor 1 | NO (-97.4%) | NO |
| 101: B Corridor 2 | NO (-79.8%) | NO |
| 101: B Stairs | N/A | N/A |
| 101: C Corridor 1 | N/A | N/A |
| 101: C Corridor 2 | NO (-54.5%) | NO |
| 101: D Corridor | NO (-22.3%) | NO |
| 101: D Stairs | NO (-71%) | NO |
| 102: A Corridor | NO (-100%) | NO |
| 102: A Double Height | NO (-39.2%) | NO |
| 102: B Corridor 1 | NO (-97.4%) | NO |
| 102: B Corridor 2 | NO (-79.5%) | NO |
| 103: B Stairs | N/A | N/A |
| 102: B Stairs | N/A | N/A |
| 103: B Stairs | N/A | N/A |
| 102: B Stairs | N/A | N/A |
| 102: C Corridor 1 | N/A | N/A |
| 102: C Corridor 2 | NO (-43.2%) | NO |
| 102: D Corridor | NO (-21%) | NO |
| 102: D Stairs | NO (-67.2%) | NO |
| 103: A Double Height | NO (-36.7%) | NO |
| 103: B Corridor 1 | NO (-97.4%) | NO |
| 103: B Corridor 2 | NO (-78.6%) | NO |
| 103: C Corridor | NO (-51.8%) | NO |
| 103: C Corridor | NO (-100%) | NO |
| 104 : B Corridor 1 | NO (-94.2%) | NO |
| 104 : B Corridor 2 | NO (-76.9%) | NO |
| 104 : C Corridor | NO (-7.2%) | NO |
| 105: B Corridor 1 | NO (-9.4%) | NO |
| 105: B Corridor 2 | NO (-70.1%) | NO |
| 104: B Stairs | N/A | N/A |
| 105: B Stairs | N/A | N/A |
| 105: C Corridor | NO (-7.1%) | NO |
| 106: B Corridor | NO (-21.8%) | NO |
| 106: B Corridor | NO (-53.2%) | NO |



| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| 106: B Stairs | NO (-42.1%) | NO |
| 107: B Corridor | NO (-21.8%) | NO |
| 107: B Corridor | NO (-52.5%) | NO |
| 107: B Stairs | NO (-42.1%) | NO |
| 109: B Corridor | NO (-21.8%) | NO |
| 109: B Corridor | NO (-52%) | NO |
| 109: B Stairs | NO (-42.1%) | NO |
| 108: B Corridor | NO (-21.8%) | NO |
| 108: B Corridor | NO (-52%) | NO |
| 108: B Stairs | NO (-42.1%) | NO |

## Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

## Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

## EPBD (Recast): Consideration of alternative energy systems

| | |
|---|---|
| **Were alternative energy systems considered and analysed as part of the design process?** | NO |
| Is evidence of such assessment available as a separate submission? | NO |
| Are any such measures included in the proposed design? | NO |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [m²] | 3804.5 | 3804.5 |
| External area [m²] | 4185.7 | 4185.7 |
| Weather | LON | LON |
| Infiltration [m³/hm²@ 50Pa] | 3 | 5 |
| Average conductance [W/K] | 987.38 | 1696.08 |
| Average U-value [W/m²K] | 0.24 | 0.41 |
| Alpha value* [%] | 10.07 | 10 |

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

## Building Use

| % Area | Building Type |
|---|---|
| | A1/A2 Retail/Financial and Professional services |
| | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways |
| | B1 Offices and Workshop businesses |
| | B2 to B7 General Industrial and Special Industrial Groups |
| | B8 Storage or Distribution |
| 49 | **C1 Hotels** |
| | C2 Residential Inst.: Hospitals and Care Homes |
| | C2 Residential Inst.: Residential schools |
| | C2 Residential Inst.: Universities and colleges |
| | C2A Secure Residential Inst. |
| 40 | **Residential spaces** |
| | D1 Non-residential Inst.: Community/Day Centre |
| | D1 Non-residential Inst.: Libraries, Museums, and Galleries |
| | D1 Non-residential Inst.: Education |
| | D1 Non-residential Inst.: Primary Health Care Building |
| | D1 Non-residential Inst.: Crown and County Courts |
| | D2 General Assembly and Leisure, Night Clubs and Theatres |
| | Others: Passenger terminals |
| | Others: Emergency services |
| | Others: Miscellaneous 24hr activities |
| 12 | **Others: Car Parks 24 hrs** |
| | Others - Stand alone utility block |

## Energy Consumption by End Use [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Heating | 1.56 | 4.22 |
| Cooling | 7.17 | 7.46 |
| Auxiliary | 1.32 | 1.49 |
| Lighting | 16.01 | 18.37 |
| Hot water | 75.48 | 16.68 |
| Equipment* | 99.01 | 99.01 |
| **TOTAL**** | **76.55** | **48.22** |

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

## Energy Production by Technology [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Photovoltaic systems | 0 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 25.01 | 0 |
| Solar thermal systems | 0 | 0 |

## Energy & $CO_2$ Emissions Summary

| | Actual | Indicative Target |
|---|---|---|
| Heating + cooling demand [MJ/m²] | 153.88 | 140.69 |
| Primary energy* [kWh/m²] | 84.65 | 140.79 |
| Total emissions [kg/m²] | 16 | 24.3 |

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.



## HVAC Systems Performance

| System Type | | Heat dem MJ/m2 | Cool dem MJ/m2 | Heat con kWh/m2 | Cool con kWh/m2 | Aux con kWh/m2 | Heat SSEEF | Cool SSEER | Heat gen SEFF | Cool gen SEER |
|---|---|---|---|---|---|---|---|---|---|---|
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity | | | | | | | | | | |
| | Actual | 22.1 | 131.8 | 1.6 | 7.2 | 1.3 | 3.92 | 5.1 | 4 | 6.83 |
| | Notional | 38.9 | 101.8 | 4.2 | 7.5 | 1.5 | 2.56 | 3.79 | ---- | ---- |

## Key to terms

| | |
|---|---|
| Heat dem [MJ/m2] | = Heating energy demand |
| Cool dem [MJ/m2] | = Cooling energy demand |
| Heat con [kWh/m2] | = Heating energy consumption |
| Cool con [kWh/m2] | = Cooling energy consumption |
| Aux con [kWh/m2] | = Auxiliary energy consumption |
| Heat SSEFF | = Heating system seasonal efficiency (for notional building, value depends on activity glazing class) |
| Cool SSEER | = Cooling system seasonal energy efficiency ratio |
| Heat gen SSEFF | = Heating generator seasonal efficiency |
| Cool gen SSEER | = Cooling generator seasonal energy efficiency ratio |
| ST | = System type |
| HS | = Heat source |
| HFT | = Heating fuel type |
| CFT | = Cooling fuel type |

## Key Features

**The BCO can give particular attention to items with specifications that are better than typically expected.**

**Building fabric**

| Element | $U_{i\text{-}Typ}$ | $U_{i\text{-}Min}$ | Surface where the minimum value occurs* |
|---|---|---|---|
| Wall | 0.23 | 0.15 | 0900001A:Surf[1] |
| Floor | 0.2 | 0.11 | 098C0001:Surf[0] |
| Roof | 0.15 | 0.11 | 098C0001:Surf[1] |
| Windows, roof windows, and rooflights | 1.5 | 1.21 | 099B0001:Surf[0] |
| Personnel doors | 1.5 | - | No Personnel doors in building |
| Vehicle access & similar large doors | 1.5 | - | No Vehicle access doors in building |
| High usage entrance doors | 1.5 | - | No High usage entrance doors in building |

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

| Air Permeability | Typical value | This building |
|---|---|---|
| m³/(h.m²) at 50 Pa | 5 | 3 |

# 15.0 APPENDIX 4 – DISTRICT HEAT NETWORKS

The following email and the heat map opposite demonstrates that the scheme does not currently have the option to connect to an existing heat network.

**Incoming Email**
from
"MacRae, Vhairi" <Vhairi.MacRae@camden.gov.uk>
on
10/12/2013 09:34

Create Mail Reply

File Ref 1 Local Authority Camden
File Ref 2 None
File Ref 3 None

To: "P.Almpouras@maxfordham.com" <P.Almpouras@maxfordham.com>
Subject: Gospel Oak CHP information request

**Associated Documents** created by: **"MacRae, Vhairi"** on **10-Dec-13**

Dear Panos,

Thank you for the email. I have asked around the person who deals with the CHP project is Susana Espino, Sustainability Officer. Her contact details are:
Susana.espino@camden.gov.uk
Telephone: 020 7974 6563

The works have been completed but new schemes cannot connect until we have another energy source available that can provide the additional capacity built into the network.

This approach is to protect the savings we have estimated for residents, which forms the basis of the business case for this project. Also, the hospital at this time cannot provide more heat that the amount agreed under the contract and therefore an alternative energy source would be required.

I hope this helps but let me know if you need further information.

Regards

Vhairi MacRae
Community Planning and Engagement Officer
Placeshaping
Culture and Environment
London Borough of Camden

Telephone: 020 7974 7407
Mobile: 075 5719 1375
Web: camden.gov.uk

Argyle Street
London WC1H 8EQ

Please consider the environment before printing this email.

**From:** P.Almpouras@maxfordham.com [mailto:P.Almpouras@maxfordham.com]
**Sent:** 03 December 2013 17:28
**To:** MacRae, Vhairi
**Subject:** Gospel Oak CHP information request

Dear Vhairi

Max Fordham is a building design company. At the moment one of our projects is a large residential project next to the Royal Free Hospital. While doing an online research I ran into the Gospel Oak Regeneration Project.
Can you please provide me answers to the following questions?

1) When is the project due to be completed? ( It was supposed to be completed already but a member of the Gospel Oak Regeneration Team told me that the main work has not started yet)
2) Is it possible to connect our project to that network? (Approximately 70 dwellings in total)
3) Could we have the technical specifications of the project or contact details to obtain the required technical information?
4) Assuming that our dwellings are connected to the CHP network, who is the responsible party that we need to get an agreement with?

Looking forward to your response.

Kind regards
Panos Almpouras