

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.16  
Printed on 04 July 2022 at 10:54:45

## Project Information:

**Assessed By:** Graham Suttill (STRO032448)

**Building Type:** Detached House

## Dwelling Details:

### NEW DWELLING DESIGN STAGE

Total Floor Area: 1737.16m<sup>2</sup>

**Site Reference :** Guildens

**Plot Reference:** Guildens Gas Boiler Be Lean

**Address :** Guildens, Courtenay Avenue, London, N6 4LP

## Client Details:

**Name:** Carnell Warren Associates Ltd

**Address :** Duke St, Woking, GU21 5BA

**This report covers items included within the SAP calculations.  
It is not a complete report of regulations compliance.**

## 1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 13.37 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 12.02 kg/m<sup>2</sup> **OK**

## 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 64.6 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 53.4 kWh/m<sup>2</sup> **OK**

## 2 Fabric U-values

| Element       | Average          | Highest          |           |
|---------------|------------------|------------------|-----------|
| External wall | 0.15 (max. 0.30) | 0.15 (max. 0.70) | <b>OK</b> |
| Floor         | 0.13 (max. 0.25) | 0.13 (max. 0.70) | <b>OK</b> |
| Roof          | 0.13 (max. 0.20) | 0.13 (max. 0.35) | <b>OK</b> |
| Openings      | 1.41 (max. 2.00) | 1.60 (max. 3.30) | <b>OK</b> |

## 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

## 3 Air permeability

Air permeability at 50 pascals 3.00 (design value)  
Maximum 10.0 **OK**

## 4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 4.50 kWh/day  
Permitted by DBSCG: 5.88 kWh/day  
Primary pipework insulated: Yes **OK**

## 6 Controls

Space heating controls: Flat rate charging, programmer and at least two room thermostats **OK**  
Hot water controls: Cylinderstat **OK**

# Regulations Compliance Report

## 7 Low energy lights

|                                                     |        |    |
|-----------------------------------------------------|--------|----|
| Percentage of fixed lights with low-energy fittings | 100.0% |    |
| Minimum                                             | 75.0%  | OK |

## 8 Mechanical ventilation

|                                      |      |    |
|--------------------------------------|------|----|
| Continuous supply and extract system |      |    |
| Specific fan power:                  | 0.63 |    |
| Maximum                              | 1.5  | OK |
| MVHR efficiency:                     | 90%  |    |
| Minimum                              | 70%  | OK |

## 9 Summertime temperature

|                                   |                     |    |
|-----------------------------------|---------------------|----|
| Overheating risk (Thames valley): | Not significant     | OK |
| Based on:                         |                     |    |
| Overshading:                      | Average or unknown  |    |
| Windows facing: West              | 43.37m <sup>2</sup> |    |
| Windows facing: West              | 4.81m <sup>2</sup>  |    |
| Windows facing: North             | 23.31m <sup>2</sup> |    |
| Windows facing: North             | 3.03m <sup>2</sup>  |    |
| Windows facing: East              | 104.6m <sup>2</sup> |    |
| Windows facing: East              | 4.76m <sup>2</sup>  |    |
| Windows facing: South             | 1.52m <sup>2</sup>  |    |
| Windows facing: South             | 5.58m <sup>2</sup>  |    |
| Roof windows facing: Horizontal   | 7.72m <sup>2</sup>  |    |
| Roof windows facing: Horizontal   | 8.96m <sup>2</sup>  |    |
| Ventilation rate:                 | 4.00                |    |

## 10 Key features

|                                                  |                                      |
|--------------------------------------------------|--------------------------------------|
| Air permeability                                 | 3.0 m <sup>3</sup> /m <sup>2</sup> h |
| Community heating, heat from boilers – mains gas |                                      |
| Fixed cooling system                             |                                      |

# DER WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Graham Suttill  
**Software Name:** Stroma FSAP 2012

**Stroma Number:** STRO032448  
**Software Version:** Version: 1.0.5.16

**Property Address:** Guildens Gas Boiler Be Lean

**Address :** Guildens, Courtenay Avenue, London, N6 4LP

## 1. Overall dwelling dimensions:

|                                                           | Area(m <sup>2</sup> )                |        | Av. Height(m)                     |                                      | Volume(m <sup>3</sup> )              |
|-----------------------------------------------------------|--------------------------------------|--------|-----------------------------------|--------------------------------------|--------------------------------------|
| Basement                                                  | <input type="text" value="127.44"/>  | (1a) x | <input type="text" value="3.5"/>  | (2a) =                               | <input type="text" value="446.04"/>  |
| Ground floor                                              | <input type="text" value="511.57"/>  | (1b) x | <input type="text" value="3.1"/>  | (2b) =                               | <input type="text" value="1585.87"/> |
| First floor                                               | <input type="text" value="414.14"/>  | (1c) x | <input type="text" value="4.4"/>  | (2c) =                               | <input type="text" value="1822.22"/> |
| Second floor                                              | <input type="text" value="405.13"/>  | (1d) x | <input type="text" value="3.44"/> | (2d) =                               | <input type="text" value="1393.65"/> |
| Third floor                                               | <input type="text" value="278.88"/>  | (1e) x | <input type="text" value="2.83"/> | (2e) =                               | <input type="text" value="789.23"/>  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | <input type="text" value="1737.16"/> | (4)    |                                   |                                      |                                      |
| Dwelling volume                                           |                                      |        |                                   | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | <input type="text" value="6037"/>    |

## 2. Ventilation rate:

|                              | main heating                   | secondary heating | other                          | total                          | m <sup>3</sup> per hour         |
|------------------------------|--------------------------------|-------------------|--------------------------------|--------------------------------|---------------------------------|
| Number of chimneys           | <input type="text" value="0"/> | +                 | <input type="text" value="0"/> | +                              | <input type="text" value="0"/>  |
| Number of open flues         | <input type="text" value="0"/> | +                 | <input type="text" value="0"/> | +                              | <input type="text" value="0"/>  |
| Number of intermittent fans  |                                |                   |                                | <input type="text" value="0"/> | <input type="text" value="0"/>  |
| Number of passive vents      |                                |                   |                                | <input type="text" value="8"/> | <input type="text" value="80"/> |
| Number of flueless gas fires |                                |                   |                                | <input type="text" value="0"/> | <input type="text" value="0"/>  |

## Air changes per hour

|                                                                                                                                                                                                                                                    |                                          |               |                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------|-----------------------------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =                                                                                                                                                                          | <input type="text" value="80"/>          | ÷ (5) =       | <input type="text" value="0.01"/> |
| <i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>                                                                                                                          |                                          |               |                                   |
| Number of storeys in the dwelling (ns)                                                                                                                                                                                                             |                                          |               | <input type="text" value="0"/>    |
| Additional infiltration                                                                                                                                                                                                                            |                                          | [(9)-1]x0.1 = | <input type="text" value="0"/>    |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction<br><i>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</i> |                                          |               | <input type="text" value="0"/>    |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0                                                                                                                                                                      |                                          |               | <input type="text" value="0"/>    |
| If no draught lobby, enter 0.05, else enter 0                                                                                                                                                                                                      |                                          |               | <input type="text" value="0"/>    |
| Percentage of windows and doors draught stripped                                                                                                                                                                                                   |                                          |               | <input type="text" value="0"/>    |
| Window infiltration                                                                                                                                                                                                                                | 0.25 - [0.2 x (14) ÷ 100] =              |               | <input type="text" value="0"/>    |
| Infiltration rate                                                                                                                                                                                                                                  | (8) + (10) + (11) + (12) + (13) + (15) = |               | <input type="text" value="0"/>    |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area                                                                                                                                                  |                                          |               | <input type="text" value="3"/>    |
| If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)                                                                                                                                                           |                                          |               | <input type="text" value="0.16"/> |
| <i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>                                                                                                                            |                                          |               |                                   |
| Number of sides sheltered                                                                                                                                                                                                                          |                                          |               | <input type="text" value="3"/>    |
| Shelter factor                                                                                                                                                                                                                                     | (20) = 1 - [0.075 x (19)] =              |               | <input type="text" value="0.78"/> |
| Infiltration rate incorporating shelter factor                                                                                                                                                                                                     | (21) = (18) x (20) =                     |               | <input type="text" value="0.13"/> |

# DER WorkSheet: New dwelling design stage

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= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
|--------|-----|---|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|

Wind Factor (22a)m = (22)m ÷ 4

|         |      |      |      |     |      |      |      |      |   |      |      |      |
|---------|------|------|------|-----|------|------|------|------|---|------|------|------|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |
|---------|------|------|------|-----|------|------|------|------|---|------|------|------|

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

|  |      |      |      |      |      |      |      |      |      |      |      |      |
|--|------|------|------|------|------|------|------|------|------|------|------|------|
|  | 0.16 | 0.16 | 0.15 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |
|--|------|------|------|------|------|------|------|------|------|------|------|------|

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) =

76.5 (23c)

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

|         |      |      |      |      |      |      |      |      |      |      |      |      |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|
| (24a)m= | 0.28 | 0.28 | 0.27 | 0.26 | 0.25 | 0.24 | 0.24 | 0.23 | 0.24 | 0.25 | 0.26 | 0.27 |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|

(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= | 0.28 | 0.28 | 0.27 | 0.26 | 0.25 | 0.24 | 0.24 | 0.23 | 0.24 | 0.25 | 0.26 | 0.27 |
|--------|------|------|------|------|------|------|------|------|------|------|------|------|

(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 |
|-------------------|-----------------|-------------|----------------|-------------------------|-------------|-----------------|------------|
| Doors Type 1      |                 |             | 2.79           | x 1.6                   | = 4.464     |                 | (26)       |
| Doors Type 2      |                 |             | 1.89           | x 1.6                   | = 3.024     |                 | (26)       |
| Doors Type 3      |                 |             | 2.84           | x 1.6                   | = 4.544     |                 | (26)       |
| Windows Type 1    |                 |             | 43.37          | x 1/[1/( 1.4 )+ 0.04] = | 57.5        |                 | (27)       |
| Windows Type 2    |                 |             | 4.81           | x 1/[1/( 1.4 )+ 0.04] = | 6.38        |                 | (27)       |
| Windows Type 3    |                 |             | 23.31          | x 1/[1/( 1.4 )+ 0.04] = | 30.9        |                 | (27)       |
| Windows Type 4    |                 |             | 3.03           | x 1/[1/( 1.4 )+ 0.04] = | 4.02        |                 | (27)       |
| Windows Type 5    |                 |             | 104.6          | x 1/[1/( 1.4 )+ 0.04] = | 138.67      |                 | (27)       |
| Windows Type 6    |                 |             | 4.76           | x 1/[1/( 1.4 )+ 0.04] = | 6.31        |                 | (27)       |
| Windows Type 7    |                 |             | 1.52           | x 1/[1/( 1.4 )+ 0.04] = | 2.02        |                 | (27)       |
| Windows Type 8    |                 |             | 5.58           | x 1/[1/( 1.4 )+ 0.04] = | 7.4         |                 | (27)       |
| Rooflights Type 1 |                 |             | 7.72           | x 1/[1/(1.4) + 0.04] =  | 10.808      |                 | (27b)      |
| Rooflights Type 2 |                 |             | 8.96           | x 1/[1/(1.4) + 0.04] =  | 12.544      |                 | (27b)      |

## DER WorkSheet: New dwelling design stage

|                                        |        |        |         |   |      |   |         |  |  |      |
|----------------------------------------|--------|--------|---------|---|------|---|---------|--|--|------|
| Floor Type 1                           |        |        | 127.44  | x | 0.13 | = | 16.5672 |  |  | (28) |
| Floor Type 2                           |        |        | 385.25  | x | 0.13 | = | 50.0825 |  |  | (28) |
| Floor Type 3                           |        |        | 20.04   | x | 0.13 | = | 2.6052  |  |  | (28) |
| Floor Type 4                           |        |        | 44.22   | x | 0.13 | = | 5.7486  |  |  | (28) |
| Walls Type1                            | 307.35 | 0      | 307.35  | x | 0.15 | = | 46.1    |  |  | (29) |
| Walls Type2                            | 958.47 | 182.49 | 775.98  | x | 0.15 | = | 116.4   |  |  | (29) |
| Walls Type3                            | 34.74  | 1.89   | 32.85   | x | 0.15 | = | 4.93    |  |  | (29) |
| Walls Type4                            | 118.69 | 0      | 118.69  | x | 0.15 | = | 17.8    |  |  | (29) |
| Walls Type5                            | 39.42  | 14.12  | 25.3    | x | 0.15 | = | 3.79    |  |  | (29) |
| Roof Type1                             | 42.14  | 0      | 42.14   | x | 0.13 | = | 5.48    |  |  | (30) |
| Roof Type2                             | 63.68  | 7.72   | 55.96   | x | 0.13 | = | 7.27    |  |  | (30) |
| Roof Type3                             | 45.09  | 0      | 45.09   | x | 0.13 | = | 5.86    |  |  | (30) |
| Roof Type4                             | 11.44  | 0      | 11.44   | x | 0.13 | = | 1.49    |  |  | (30) |
| Roof Type5                             | 82.04  | 0      | 82.04   | x | 0.13 | = | 10.67   |  |  | (30) |
| Roof Type6                             | 112.03 | 0      | 112.03  | x | 0.13 | = | 14.56   |  |  | (30) |
| Roof Type7                             | 20.24  | 0      | 20.24   | x | 0.13 | = | 2.63    |  |  | (30) |
| Roof Type8                             | 112.03 | 8.96   | 103.07  | x | 0.13 | = | 13.4    |  |  | (30) |
| Roof Type9                             | 191.38 | 0      | 191.38  | x | 0.13 | = | 24.88   |  |  | (30) |
| Total area of elements, m <sup>2</sup> |        |        | 2715.69 |   |      |   |         |  |  | (31) |

\* for windows and roof windows, use effective window U-value calculated using formula  $1/[(1/U\text{-value})+0.04]$  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) =                  | 637.61    | (33) |
| Heat capacity Cm = S(A x k)                                    | ((28)...(30) + (32) + (32a)...(32e) = | 163815.52 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m <sup>2</sup> K | 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 | 134.86 | (36) |
|---------------------------------------------------------|--------|------|

if details of thermal bridging are not known (36) = 0.05 x (31)

|                        |               |        |      |
|------------------------|---------------|--------|------|
| Total fabric heat loss | (33) + (36) = | 772.46 | (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= | 555.45 | 549.15 | 542.85 | 511.34 | 505.04 | 473.54 | 473.54 | 467.24 | 486.14 | 505.04 | 517.65 | 530.25 | (38) |

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

|                                          |         |         |         |         |         |      |      |        |        |         |         |         |         |      |
|------------------------------------------|---------|---------|---------|---------|---------|------|------|--------|--------|---------|---------|---------|---------|------|
| (39)m=                                   | 1327.92 | 1321.62 | 1315.32 | 1283.81 | 1277.51 | 1246 | 1246 | 1239.7 | 1258.6 | 1277.51 | 1290.11 | 1302.71 |         |      |
| Average = Sum(39) <sub>1...12</sub> /12= |         |         |         |         |         |      |      |        |        |         |         |         | 1282.23 | (39) |

|                                               |                     |  |
|-----------------------------------------------|---------------------|--|
| Heat loss parameter (HLP), W/m <sup>2</sup> K | (40)m = (39)m ÷ (4) |  |
|-----------------------------------------------|---------------------|--|

|                                          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| (40)m=                                   | 0.76 | 0.76 | 0.76 | 0.74 | 0.74 | 0.72 | 0.72 | 0.71 | 0.72 | 0.74 | 0.74 | 0.75 |      |      |
| Average = Sum(40) <sub>1...12</sub> /12= |      |      |      |      |      |      |      |      |      |      |      |      | 0.74 | (40) |

Number of days in month (Table 1a)

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

### 4. Water heating energy requirement:

kWh/year:

|                      |   |      |
|----------------------|---|------|
| Assumed occupancy, N | 5 | (42) |
|----------------------|---|------|

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)<sup>2</sup>)] + 0.0013 x (TFA -13.9)

Stroma FFA SAP 12.9, Version: 1.0.5.16 (SAP 9.92) - <http://www.stroma.com>

|                                                                             |        |      |
|-----------------------------------------------------------------------------|--------|------|
| Annual average hot water usage in litres per day Vd average = (25 x N) + 36 | 152.96 | (43) |
|-----------------------------------------------------------------------------|--------|------|

## DER WorkSheet: New dwelling design stage

Energy content of hot water used - calculated monthly =  $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$  kWh/month (see Tables 1b, 1c, 1d)

|                                     |        |        |        |        |        |        |        |        |        |        |        |        |         |      |
|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| (45)m=                              | 249.51 | 218.22 | 225.19 | 196.32 | 188.38 | 162.56 | 150.63 | 172.85 | 174.92 | 203.85 | 222.52 | 241.64 |         |      |
| Total = Sum(45) <sub>1...12</sub> = |        |        |        |        |        |        |        |        |        |        |        |        | 2406.59 | (45) |

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| (46)m= | 37.43 | 32.73 | 33.78 | 29.45 | 28.26 | 24.38 | 22.59 | 25.93 | 26.24 | 30.58 | 33.38 | 36.25 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

Water storage loss:

|                                                                                 |     |      |
|---------------------------------------------------------------------------------|-----|------|
| Storage volume (litres) including any solar or WWHRS storage within same vessel | 800 | (47) |
|---------------------------------------------------------------------------------|-----|------|

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

|                                                               |     |      |
|---------------------------------------------------------------|-----|------|
| a) If manufacturer's declared loss factor is known (kWh/day): | 4.5 | (48) |
|---------------------------------------------------------------|-----|------|

|                                  |         |      |
|----------------------------------|---------|------|
| Temperature factor from Table 2b | 0.79299 | (49) |
|----------------------------------|---------|------|

|                                          |               |      |      |
|------------------------------------------|---------------|------|------|
| Energy lost from water storage, kWh/year | (48) x (49) = | 3.57 | (50) |
|------------------------------------------|---------------|------|------|

b) If manufacturer's declared cylinder loss factor is not known:

|                                                            |   |      |
|------------------------------------------------------------|---|------|
| Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51) |
|------------------------------------------------------------|---|------|

If community heating see section 4.3

|                             |   |      |
|-----------------------------|---|------|
| Volume factor from Table 2a | 0 | (52) |
|-----------------------------|---|------|

|                                  |   |      |
|----------------------------------|---|------|
| Temperature factor from Table 2b | 0 | (53) |
|----------------------------------|---|------|

|                                          |                             |   |      |
|------------------------------------------|-----------------------------|---|------|
| Energy lost from water storage, kWh/year | (47) x (51) x (52) x (53) = | 0 | (54) |
|------------------------------------------|-----------------------------|---|------|

|                            |      |      |
|----------------------------|------|------|
| Enter (50) or (54) in (55) | 3.57 | (55) |
|----------------------------|------|------|

Water storage loss calculated for each month ((56)m = (55) x (41)m)

|        |        |       |        |        |        |        |        |        |        |        |        |        |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| (56)m= | 110.62 | 99.92 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

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= | 110.62 | 99.92 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

|                                            |   |      |
|--------------------------------------------|---|------|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |
|--------------------------------------------|---|------|

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

|        |       |       |       |       |       |       |       |       |       |       |       |       |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

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

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

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

|        |       |        |        |        |        |        |        |        |        |        |        |        |  |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| (62)m= | 383.4 | 339.15 | 359.07 | 325.89 | 322.26 | 292.12 | 284.52 | 306.74 | 304.48 | 337.73 | 352.08 | 375.52 |  |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

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 |  |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|--|

Output from water heater

|                                                     |       |        |        |        |        |        |        |        |        |        |        |        |         |      |
|-----------------------------------------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| (64)m=                                              | 383.4 | 339.15 | 359.07 | 325.89 | 322.26 | 292.12 | 284.52 | 306.74 | 304.48 | 337.73 | 352.08 | 375.52 |         |      |
| Output from water heater (annual) <sub>1...12</sub> |       |        |        |        |        |        |        |        |        |        |        |        | 3982.97 | (64) |

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

|        |        |       |        |        |        |       |        |        |        |        |        |        |  |
|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--|
| (65)m= | 190.07 | 169.3 | 181.98 | 168.93 | 169.74 | 157.7 | 157.19 | 164.58 | 161.81 | 174.89 | 177.64 | 187.45 |  |
|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--|

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 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

## DER WorkSheet: New dwelling design stage

(66)m= 

|        |        |        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (66)

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

(67)m= 

|        |        |       |       |       |       |       |       |      |        |        |        |
|--------|--------|-------|-------|-------|-------|-------|-------|------|--------|--------|--------|
| 125.27 | 111.27 | 90.49 | 68.51 | 51.21 | 43.23 | 46.71 | 60.72 | 81.5 | 103.48 | 120.78 | 128.76 |
|--------|--------|-------|-------|-------|-------|-------|-------|------|--------|--------|--------|

 (67)

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

(68)m= 

|        |         |         |         |         |         |        |        |        |         |         |         |
|--------|---------|---------|---------|---------|---------|--------|--------|--------|---------|---------|---------|
| 1307.5 | 1321.06 | 1286.87 | 1214.09 | 1122.21 | 1035.85 | 978.16 | 964.59 | 998.78 | 1071.57 | 1163.45 | 1249.81 |
|--------|---------|---------|---------|---------|---------|--------|--------|--------|---------|---------|---------|

 (68)

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

(69)m= 

|    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|
| 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
|----|----|----|----|----|----|----|----|----|----|----|----|

 (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= 

|         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

 (71)

Water heating gains (Table 5)

(72)m= 

|        |        |       |        |        |        |        |        |        |        |        |        |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 255.47 | 251.94 | 244.6 | 234.63 | 228.15 | 219.03 | 211.28 | 221.21 | 224.74 | 235.06 | 246.72 | 251.95 |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (72)

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

(73)m= 

|         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1786.24 | 1782.27 | 1719.97 | 1615.22 | 1499.57 | 1396.12 | 1334.16 | 1344.53 | 1403.03 | 1508.12 | 1628.96 | 1728.52 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

 (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<br>Table 6d |                                       |      | Area<br>m <sup>2</sup> | Flux<br>Table 6a                       |       |   | g_<br>Table 6b                         | FF<br>Table 6c |   |                                       | Gains<br>(W) |   |                                      |     |   |                                         |        |      |
|--------------|---------------------------|---------------------------------------|------|------------------------|----------------------------------------|-------|---|----------------------------------------|----------------|---|---------------------------------------|--------------|---|--------------------------------------|-----|---|-----------------------------------------|--------|------|
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>10.63</td></tr></table> | 10.63          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>86.57</td></tr></table>  | 86.57  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 10.63        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 86.57        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>10.63</td></tr></table> | 10.63          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>11.25</td></tr></table>  | 11.25  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 10.63        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 11.25        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>20.32</td></tr></table> | 20.32          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>165.44</td></tr></table> | 165.44 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 20.32        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 165.44       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>20.32</td></tr></table> | 20.32          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>21.51</td></tr></table>  | 21.51  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 20.32        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 21.51        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>34.53</td></tr></table> | 34.53          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>281.13</td></tr></table> | 281.13 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 34.53        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 281.13       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>34.53</td></tr></table> | 34.53          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>36.54</td></tr></table>  | 36.54  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 34.53        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 36.54        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>55.46</td></tr></table> | 55.46          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>451.57</td></tr></table> | 451.57 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 55.46        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 451.57       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>55.46</td></tr></table> | 55.46          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>58.7</td></tr></table>   | 58.7   | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 55.46        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 58.7         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>74.72</td></tr></table> | 74.72          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>608.3</td></tr></table>  | 608.3  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.72        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 608.3        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>74.72</td></tr></table> | 74.72          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>79.07</td></tr></table>  | 79.07  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.72        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.07        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>79.99</td></tr></table> | 79.99          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>651.2</td></tr></table>  | 651.2  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.99        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 651.2        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>79.99</td></tr></table> | 79.99          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>84.65</td></tr></table>  | 84.65  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.99        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 84.65        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>74.68</td></tr></table> | 74.68          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>607.98</td></tr></table> | 607.98 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.68        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 607.98       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>74.68</td></tr></table> | 74.68          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>79.03</td></tr></table>  | 79.03  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.68        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.03        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>59.25</td></tr></table> | 59.25          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>482.36</td></tr></table> | 482.36 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 59.25        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 482.36       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>59.25</td></tr></table> | 59.25          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>62.7</td></tr></table>   | 62.7   | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 59.25        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 62.7         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>41.52</td></tr></table> | 41.52          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>338.01</td></tr></table> | 338.01 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 41.52        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 338.01       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>41.52</td></tr></table> | 41.52          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>43.94</td></tr></table>  | 43.94  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 41.52        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 43.94        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>24.19</td></tr></table> | 24.19          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>196.94</td></tr></table> | 196.94 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 24.19        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 196.94       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>24.19</td></tr></table> | 24.19          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>25.6</td></tr></table>   | 25.6   | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 24.19        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 25.6         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>13.12</td></tr></table> | 13.12          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>106.8</td></tr></table>  | 106.8  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 13.12        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 106.8        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |

## DER WorkSheet: New dwelling design stage

|       |      |      |   |       |   |        |   |      |   |     |   |         |      |
|-------|------|------|---|-------|---|--------|---|------|---|-----|---|---------|------|
| North | 0.9x | 0.77 | x | 3.03  | x | 13.12  | x | 0.63 | x | 0.8 | = | 13.88   | (74) |
| North | 0.9x | 0.77 | x | 23.31 | x | 8.86   | x | 0.63 | x | 0.8 | = | 72.17   | (74) |
| North | 0.9x | 0.77 | x | 3.03  | x | 8.86   | x | 0.63 | x | 0.8 | = | 9.38    | (74) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 19.64  | x | 0.63 | x | 0.8 | = | 717.53  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 19.64  | x | 0.63 | x | 0.8 | = | 32.65   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 38.42  | x | 0.63 | x | 0.8 | = | 1403.65 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 38.42  | x | 0.63 | x | 0.8 | = | 63.88   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 63.27  | x | 0.63 | x | 0.8 | = | 2311.61 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 63.27  | x | 0.63 | x | 0.8 | = | 105.19  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 92.28  | x | 0.63 | x | 0.8 | = | 3371.35 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 92.28  | x | 0.63 | x | 0.8 | = | 153.42  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 113.09 | x | 0.63 | x | 0.8 | = | 4131.71 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 113.09 | x | 0.63 | x | 0.8 | = | 188.02  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 115.77 | x | 0.63 | x | 0.8 | = | 4229.54 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 115.77 | x | 0.63 | x | 0.8 | = | 192.47  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 110.22 | x | 0.63 | x | 0.8 | = | 4026.7  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 110.22 | x | 0.63 | x | 0.8 | = | 183.24  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 94.68  | x | 0.63 | x | 0.8 | = | 3458.87 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 94.68  | x | 0.63 | x | 0.8 | = | 157.4   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 73.59  | x | 0.63 | x | 0.8 | = | 2688.5  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 73.59  | x | 0.63 | x | 0.8 | = | 122.34  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 45.59  | x | 0.63 | x | 0.8 | = | 1665.55 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 45.59  | x | 0.63 | x | 0.8 | = | 75.79   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 24.49  | x | 0.63 | x | 0.8 | = | 894.68  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 24.49  | x | 0.63 | x | 0.8 | = | 40.71   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 16.15  | x | 0.63 | x | 0.8 | = | 590.07  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 16.15  | x | 0.63 | x | 0.8 | = | 26.85   | (76) |
| South | 0.9x | 0.77 | x | 1.52  | x | 46.75  | x | 0.63 | x | 0.8 | = | 24.82   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 46.75  | x | 0.63 | x | 0.8 | = | 91.12   | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 76.57  | x | 0.63 | x | 0.8 | = | 40.65   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 76.57  | x | 0.63 | x | 0.8 | = | 149.23  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 97.53  | x | 0.63 | x | 0.8 | = | 51.78   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 97.53  | x | 0.63 | x | 0.8 | = | 190.09  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 110.23 | x | 0.63 | x | 0.8 | = | 58.52   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 110.23 | x | 0.63 | x | 0.8 | = | 214.84  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 114.87 | x | 0.63 | x | 0.8 | = | 60.98   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 114.87 | x | 0.63 | x | 0.8 | = | 223.88  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 110.55 | x | 0.63 | x | 0.8 | = | 58.69   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 110.55 | x | 0.63 | x | 0.8 | = | 215.45  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 108.01 | x | 0.63 | x | 0.8 | = | 57.34   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 108.01 | x | 0.63 | x | 0.8 | = | 210.51  | (78) |

## DER WorkSheet: New dwelling design stage

|            |      |      |   |       |   |        |   |      |   |     |   |         |      |
|------------|------|------|---|-------|---|--------|---|------|---|-----|---|---------|------|
| South      | 0.9x | 0.77 | x | 1.52  | x | 104.89 | x | 0.63 | x | 0.8 | = | 55.69   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 104.89 | x | 0.63 | x | 0.8 | = | 204.43  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 101.89 | x | 0.63 | x | 0.8 | = | 54.09   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 101.89 | x | 0.63 | x | 0.8 | = | 198.57  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 82.59  | x | 0.63 | x | 0.8 | = | 43.84   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 82.59  | x | 0.63 | x | 0.8 | = | 160.95  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 55.42  | x | 0.63 | x | 0.8 | = | 29.42   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 55.42  | x | 0.63 | x | 0.8 | = | 108     | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 40.4   | x | 0.63 | x | 0.8 | = | 21.45   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 40.4   | x | 0.63 | x | 0.8 | = | 78.73   | (78) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 19.64  | x | 0.63 | x | 0.8 | = | 297.51  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 19.64  | x | 0.63 | x | 0.8 | = | 33      | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 38.42  | x | 0.63 | x | 0.8 | = | 581.99  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 38.42  | x | 0.63 | x | 0.8 | = | 64.55   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 63.27  | x | 0.63 | x | 0.8 | = | 958.46  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 63.27  | x | 0.63 | x | 0.8 | = | 106.3   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 92.28  | x | 0.63 | x | 0.8 | = | 1397.85 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 92.28  | x | 0.63 | x | 0.8 | = | 155.03  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 113.09 | x | 0.63 | x | 0.8 | = | 1713.12 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 113.09 | x | 0.63 | x | 0.8 | = | 190     | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 115.77 | x | 0.63 | x | 0.8 | = | 1753.68 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 115.77 | x | 0.63 | x | 0.8 | = | 194.49  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 110.22 | x | 0.63 | x | 0.8 | = | 1669.58 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 110.22 | x | 0.63 | x | 0.8 | = | 185.17  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 94.68  | x | 0.63 | x | 0.8 | = | 1434.14 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 94.68  | x | 0.63 | x | 0.8 | = | 159.06  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 73.59  | x | 0.63 | x | 0.8 | = | 1114.72 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 73.59  | x | 0.63 | x | 0.8 | = | 123.63  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 45.59  | x | 0.63 | x | 0.8 | = | 690.58  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 45.59  | x | 0.63 | x | 0.8 | = | 76.59   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 24.49  | x | 0.63 | x | 0.8 | = | 370.96  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 24.49  | x | 0.63 | x | 0.8 | = | 41.14   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 16.15  | x | 0.63 | x | 0.8 | = | 244.66  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 16.15  | x | 0.63 | x | 0.8 | = | 27.13   | (80) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 26     | x | 0.63 | x | 0.8 | = | 91.05   | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 26     | x | 0.63 | x | 0.8 | = | 105.67  | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 54     | x | 0.63 | x | 0.8 | = | 189.1   | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 54     | x | 0.63 | x | 0.8 | = | 219.47  | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 96     | x | 0.63 | x | 0.8 | = | 336.17  | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 96     | x | 0.63 | x | 0.8 | = | 390.17  | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 150    | x | 0.63 | x | 0.8 | = | 525.27  | (82) |

## DER WorkSheet: New dwelling design stage

|                 |   |   |      |   |     |   |      |   |     |   |        |      |
|-----------------|---|---|------|---|-----|---|------|---|-----|---|--------|------|
| Rooflights 0.9x | 1 | x | 8.96 | x | 150 | x | 0.63 | x | 0.8 | = | 609.64 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 192 | x | 0.63 | x | 0.8 | = | 672.34 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 192 | x | 0.63 | x | 0.8 | = | 780.34 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 200 | x | 0.63 | x | 0.8 | = | 700.36 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 200 | x | 0.63 | x | 0.8 | = | 812.85 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 189 | x | 0.63 | x | 0.8 | = | 661.84 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 189 | x | 0.63 | x | 0.8 | = | 768.14 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 157 | x | 0.63 | x | 0.8 | = | 549.78 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 157 | x | 0.63 | x | 0.8 | = | 638.09 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 115 | x | 0.63 | x | 0.8 | = | 402.71 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 115 | x | 0.63 | x | 0.8 | = | 467.39 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 66  | x | 0.63 | x | 0.8 | = | 231.12 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 66  | x | 0.63 | x | 0.8 | = | 268.24 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 33  | x | 0.63 | x | 0.8 | = | 115.56 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 33  | x | 0.63 | x | 0.8 | = | 134.12 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 21  | x | 0.63 | x | 0.8 | = | 73.54  | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 21  | x | 0.63 | x | 0.8 | = | 85.35  | (82) |

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

|        |         |         |         |         |         |         |         |         |        |         |         |         |      |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|------|
| (83)m= | 1491.17 | 2899.45 | 4767.44 | 6996.18 | 8647.76 | 8893.39 | 8449.53 | 7202.52 | 5553.9 | 3435.21 | 1855.28 | 1229.33 | (83) |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|------|

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

|        |         |         |         |        |          |          |         |         |         |         |         |         |      |
|--------|---------|---------|---------|--------|----------|----------|---------|---------|---------|---------|---------|---------|------|
| (84)m= | 3277.42 | 4681.73 | 6487.41 | 8611.4 | 10147.33 | 10289.51 | 9783.69 | 8547.05 | 6956.92 | 4943.33 | 3484.24 | 2957.84 | (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= | 1   | 1   | 1   | 0.99 | 0.94 | 0.75 | 0.56 | 0.66 | 0.95 | 1   | 1   | 1   | (86) |

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

|        |      |       |       |       |       |       |    |       |       |       |       |      |      |
|--------|------|-------|-------|-------|-------|-------|----|-------|-------|-------|-------|------|------|
| (87)m= | 19.9 | 20.03 | 20.27 | 20.59 | 20.86 | 20.98 | 21 | 20.99 | 20.88 | 20.51 | 20.16 | 19.9 | (87) |
|--------|------|-------|-------|-------|-------|-------|----|-------|-------|-------|-------|------|------|

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

|        |       |       |       |       |       |       |       |       |       |       |      |      |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|
| (88)m= | 20.28 | 20.29 | 20.29 | 20.31 | 20.31 | 20.33 | 20.33 | 20.33 | 20.32 | 20.31 | 20.3 | 20.3 | (88) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|

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

|        |   |   |   |      |      |      |      |      |      |   |   |   |      |
|--------|---|---|---|------|------|------|------|------|------|---|---|---|------|
| (89)m= | 1 | 1 | 1 | 0.99 | 0.91 | 0.68 | 0.47 | 0.57 | 0.93 | 1 | 1 | 1 | (89) |
|--------|---|---|---|------|------|------|------|------|------|---|---|---|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (90)m= | 19.24 | 19.38 | 19.61 | 19.95 | 20.21 | 20.32 | 20.33 | 20.33 | 20.24 | 19.87 | 19.51 | 19.25 | (90) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

fLA = Living area ÷ (4) = 0.04 (91)

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

|        |       |      |       |       |       |       |       |       |       |      |       |       |      |
|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|
| (92)m= | 19.27 | 19.4 | 19.64 | 19.98 | 20.23 | 20.34 | 20.35 | 20.35 | 20.26 | 19.9 | 19.54 | 19.27 | (92) |
|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|

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

|        |       |      |       |       |       |       |       |       |       |      |       |       |      |
|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|
| (93)m= | 19.17 | 19.3 | 19.54 | 19.88 | 20.13 | 20.24 | 20.25 | 20.25 | 20.16 | 19.8 | 19.44 | 19.17 | (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 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

## DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

|        |   |   |   |      |     |      |      |      |      |   |   |   |      |
|--------|---|---|---|------|-----|------|------|------|------|---|---|---|------|
| (94)m= | 1 | 1 | 1 | 0.99 | 0.9 | 0.67 | 0.46 | 0.56 | 0.92 | 1 | 1 | 1 | (94) |
|--------|---|---|---|------|-----|------|------|------|------|---|---|---|------|

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

|        |         |         |         |        |         |         |         |         |         |         |         |         |      |
|--------|---------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (95)m= | 3277.41 | 4681.55 | 6483.41 | 8516.2 | 9174.61 | 6896.98 | 4543.42 | 4751.25 | 6382.66 | 4938.16 | 3484.19 | 2957.84 | (95) |
|--------|---------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|------|

Monthly average external temperature from Table 8

|        |     |     |     |     |      |      |      |      |      |      |     |     |      |
|--------|-----|-----|-----|-----|------|------|------|------|------|------|-----|-----|------|
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
|--------|-----|-----|-----|-----|------|------|------|------|------|------|-----|-----|------|

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

|        |          |          |          |          |          |         |         |         |         |          |          |          |      |
|--------|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|------|
| (97)m= | 19743.46 | 19036.25 | 17150.54 | 14091.28 | 10775.23 | 7032.91 | 4551.54 | 4778.54 | 7632.91 | 11752.56 | 15918.34 | 19506.22 | (97) |
|--------|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|------|

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

|                                                               |          |         |         |         |         |   |   |   |   |         |         |          |      |
|---------------------------------------------------------------|----------|---------|---------|---------|---------|---|---|---|---|---------|---------|----------|------|
| (98)m=                                                        | 12250.75 | 9646.36 | 7936.35 | 4014.06 | 1190.86 | 0 | 0 | 0 | 0 | 5069.91 | 8952.59 | 12311.99 |      |
| Total per year (kWh/year) = Sum(98) <sub>1...5,9...12</sub> = |          |         |         |         |         |   |   |   |   |         |         | 61372.87 | (98) |

Space heating requirement in kWh/m<sup>2</sup>/year

|       |      |
|-------|------|
| 35.33 | (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 | 11712.41 | 9220.4 | 9421.71 | 0 | 0 | 0 | 0 | (100) |
|---------|---|---|---|---|---|----------|--------|---------|---|---|---|---|-------|

Utilisation factor for loss hm

|         |   |   |   |   |   |     |      |      |   |   |   |   |       |
|---------|---|---|---|---|---|-----|------|------|---|---|---|---|-------|
| (101)m= | 0 | 0 | 0 | 0 | 0 | 0.9 | 0.96 | 0.91 | 0 | 0 | 0 | 0 | (101) |
|---------|---|---|---|---|---|-----|------|------|---|---|---|---|-------|

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

|         |   |   |   |   |   |          |         |        |   |   |   |   |       |
|---------|---|---|---|---|---|----------|---------|--------|---|---|---|---|-------|
| (102)m= | 0 | 0 | 0 | 0 | 0 | 10521.52 | 8820.29 | 8612.4 | 0 | 0 | 0 | 0 | (102) |
|---------|---|---|---|---|---|----------|---------|--------|---|---|---|---|-------|

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

|         |   |   |   |   |   |          |          |          |   |   |   |   |       |
|---------|---|---|---|---|---|----------|----------|----------|---|---|---|---|-------|
| (103)m= | 0 | 0 | 0 | 0 | 0 | 12182.57 | 11592.66 | 10200.69 | 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 x (98)m

|                    |   |   |   |   |   |         |         |         |   |   |   |         |       |
|--------------------|---|---|---|---|---|---------|---------|---------|---|---|---|---------|-------|
| (104)m=            | 0 | 0 | 0 | 0 | 0 | 1195.96 | 2062.65 | 1181.69 | 0 | 0 | 0 | 0       |       |
| Total = Sum(104) = |   |   |   |   |   |         |         |         |   |   |   | 4440.29 | (104) |

Cooled fraction

f C = cooled area ÷ (4) =

|   |       |
|---|-------|
| 1 | (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 x (105) x (106)m

|         |   |   |   |   |   |        |        |       |   |   |   |   |  |
|---------|---|---|---|---|---|--------|--------|-------|---|---|---|---|--|
| (107)m= | 0 | 0 | 0 | 0 | 0 | 298.96 | 515.61 | 295.4 | 0 | 0 | 0 | 0 |  |
|---------|---|---|---|---|---|--------|--------|-------|---|---|---|---|--|

Total = Sum(107) =

|         |       |
|---------|-------|
| 1109.97 | (107) |
|---------|-------|

Space cooling requirement in kWh/m<sup>2</sup>/year

(107) ÷ (4) =

|      |       |
|------|-------|
| 0.64 | (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 boilers

|   |        |
|---|--------|
| 1 | (303a) |
|---|--------|

Fraction of total space heat from Community boilers

(302) x (303a) =

|   |        |
|---|--------|
| 1 | (304a) |
|---|--------|

## DER WorkSheet: New dwelling design stage

|                                                                                                                                         |                                                             |                 |        |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------|--------|
| Factor for control and charging method (Table 4c(3)) for community heating system                                                       |                                                             | 1.05            | (305)  |
| Distribution loss factor (Table 12c) for community heating system                                                                       |                                                             | 1.05            | (306)  |
| <b>Space heating</b>                                                                                                                    |                                                             | <b>kWh/year</b> |        |
| Annual space heating requirement                                                                                                        |                                                             | 61372.87        |        |
| Space heat from Community boilers                                                                                                       | $(98) \times (304a) \times (305) \times (306) =$            | 67663.59        | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)                                                 |                                                             | 0               | (308)  |
| Space heating requirement from secondary/supplementary system                                                                           | $(98) \times (301) \times 100 \div (308) =$                 | 0               | (309)  |
| <b>Water heating</b>                                                                                                                    |                                                             |                 |        |
| Annual water heating requirement                                                                                                        |                                                             | 3982.97         |        |
| If DHW from community scheme:                                                                                                           |                                                             |                 |        |
| Water heat from Community boilers                                                                                                       | $(64) \times (303a) \times (305) \times (306) =$            | 4391.22         | (310a) |
| Electricity used for heat distribution                                                                                                  | $0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ | 720.55          | (313)  |
| Cooling System Energy Efficiency Ratio                                                                                                  |                                                             | 4.32            | (314)  |
| Space cooling (if there is a fixed cooling system, if not enter 0)                                                                      | $= (107) \div (314) =$                                      | 256.94          | (315)  |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside |                                                             | 5800.05         | (330a) |
| warm air heating system fans                                                                                                            |                                                             | 0               | (330b) |
| pump for solar water heating                                                                                                            |                                                             | 0               | (330g) |
| Total electricity for the above, kWh/year                                                                                               | $= (330a) + (330b) + (330g) =$                              | 5800.05         | (331)  |
| Energy for lighting (calculated in Appendix L)                                                                                          |                                                             | 2212.38         | (332)  |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332) ... (237b) =                                  |                                                             | 80324.18        | (338)  |

### 12b. CO2 Emissions – Community heating scheme

|                                                                         | Energy<br>kWh/year                                                        | Emission factor<br>kg CO2/kWh | Emissions<br>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 | 96                            | (367a)                   |
| CO2 associated with heat source 1                                       | $[(307b) + (310b)] \times 100 \div (367b) \times$                         | 0.22                          | = 16212.33 (367)         |
| Electrical energy for heat distribution                                 | $[(313) \times$                                                           | 0.52                          | = 373.96 (372)           |
| Total CO2 associated with community systems                             | $(363) \dots (366) + (368) \dots (372)$                                   |                               | = 16586.3 (373)          |
| CO2 associated with space heating (secondary)                           | $(309) \times$                                                            | 0                             | = 0 (374)                |
| CO2 associated with water from immersion heater or instantaneous heater | $(312) \times$                                                            | 0.22                          | = 0 (375)                |
| Total CO2 associated with space and water heating                       | $(373) + (374) + (375) =$                                                 |                               | 16586.3 (376)            |
| CO2 associated with space cooling                                       | $(315) \times$                                                            | 0.52                          | = 133.35 (377)           |
| CO2 associated with electricity for pumps and fans within dwelling      | $(331) \times$                                                            | 0.52                          | = 3010.23 (378)          |
| CO2 associated with electricity for lighting                            | $(332) \times$                                                            | 0.52                          | = 1148.22 (379)          |
| <b>Total CO2, kg/year</b>                                               | sum of (376) ... (382) =                                                  |                               | 20878.1 (383)            |
| <b>Dwelling CO2 Emission Rate</b>                                       | $(383) \div (4) =$                                                        |                               | 12.02 (384)              |
| <b>EI rating (section 14)</b>                                           |                                                                           |                               | 84.3 (385)               |

## DER WorkSheet: New dwelling design stage

# TER WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Graham Suttill **Stroma Number:** STRO032448  
**Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.5.16

**Property Address:** Guildens Gas Boiler Be Lean

**Address :** Guildens, Courtenay Avenue, London, N6 4LP

## 1. Overall dwelling dimensions:

|                                                           | Area(m <sup>2</sup> )                |        | Av. Height(m)                     |                                      | Volume(m <sup>3</sup> )              |
|-----------------------------------------------------------|--------------------------------------|--------|-----------------------------------|--------------------------------------|--------------------------------------|
| Basement                                                  | <input type="text" value="127.44"/>  | (1a) x | <input type="text" value="3.5"/>  | (2a) =                               | <input type="text" value="446.04"/>  |
| Ground floor                                              | <input type="text" value="511.57"/>  | (1b) x | <input type="text" value="3.1"/>  | (2b) =                               | <input type="text" value="1585.87"/> |
| First floor                                               | <input type="text" value="414.14"/>  | (1c) x | <input type="text" value="4.4"/>  | (2c) =                               | <input type="text" value="1822.22"/> |
| Second floor                                              | <input type="text" value="405.13"/>  | (1d) x | <input type="text" value="3.44"/> | (2d) =                               | <input type="text" value="1393.65"/> |
| Third floor                                               | <input type="text" value="278.88"/>  | (1e) x | <input type="text" value="2.83"/> | (2e) =                               | <input type="text" value="789.23"/>  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | <input type="text" value="1737.16"/> | (4)    |                                   |                                      |                                      |
| Dwelling volume                                           |                                      |        |                                   | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | <input type="text" value="6037"/>    |

## 2. Ventilation rate:

|                              | main heating                   | secondary heating | other                          | total                          | m <sup>3</sup> per hour         |
|------------------------------|--------------------------------|-------------------|--------------------------------|--------------------------------|---------------------------------|
| Number of chimneys           | <input type="text" value="0"/> | +                 | <input type="text" value="0"/> | +                              | <input type="text" value="0"/>  |
| Number of open flues         | <input type="text" value="0"/> | +                 | <input type="text" value="0"/> | +                              | <input type="text" value="0"/>  |
| Number of intermittent fans  |                                |                   |                                | <input type="text" value="4"/> | <input type="text" value="40"/> |
| Number of passive vents      |                                |                   |                                | <input type="text" value="0"/> | <input type="text" value="0"/>  |
| Number of flueless gas fires |                                |                   |                                | <input type="text" value="0"/> | <input type="text" value="0"/>  |

## Air changes per hour

|                                                                                                                                                                                                                                                    |                                          |               |                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------|-----------------------------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =                                                                                                                                                                          | <input type="text" value="40"/>          | ÷ (5) =       | <input type="text" value="0.01"/> |
| <i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>                                                                                                                          |                                          |               |                                   |
| Number of storeys in the dwelling (ns)                                                                                                                                                                                                             |                                          |               | <input type="text" value="0"/>    |
| Additional infiltration                                                                                                                                                                                                                            |                                          | [(9)-1]x0.1 = | <input type="text" value="0"/>    |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction<br><i>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</i> |                                          |               | <input type="text" value="0"/>    |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0                                                                                                                                                                      |                                          |               | <input type="text" value="0"/>    |
| If no draught lobby, enter 0.05, else enter 0                                                                                                                                                                                                      |                                          |               | <input type="text" value="0"/>    |
| Percentage of windows and doors draught stripped                                                                                                                                                                                                   |                                          |               | <input type="text" value="0"/>    |
| Window infiltration                                                                                                                                                                                                                                | 0.25 - [0.2 x (14) ÷ 100] =              |               | <input type="text" value="0"/>    |
| Infiltration rate                                                                                                                                                                                                                                  | (8) + (10) + (11) + (12) + (13) + (15) = |               | <input type="text" value="0"/>    |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area                                                                                                                                                  |                                          |               | <input type="text" value="5"/>    |
| If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)                                                                                                                                                             |                                          |               | <input type="text" value="0.26"/> |
| <i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>                                                                                                                            |                                          |               |                                   |
| Number of sides sheltered                                                                                                                                                                                                                          |                                          |               | <input type="text" value="3"/>    |
| Shelter factor                                                                                                                                                                                                                                     | (20) = 1 - [0.075 x (19)] =              |               | <input type="text" value="0.78"/> |
| Infiltration rate incorporating shelter factor                                                                                                                                                                                                     | (21) = (18) x (20) =                     |               | <input type="text" value="0.2"/>  |

# TER WorkSheet: New dwelling design stage

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= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
|--------|-----|---|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|

Wind Factor (22a)m = (22)m ÷ 4

|         |      |      |      |     |      |      |      |      |   |      |      |      |
|---------|------|------|------|-----|------|------|------|------|---|------|------|------|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |
|---------|------|------|------|-----|------|------|------|------|---|------|------|------|

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

|  |      |      |      |      |      |      |      |      |     |      |      |      |
|--|------|------|------|------|------|------|------|------|-----|------|------|------|
|  | 0.25 | 0.25 | 0.24 | 0.22 | 0.21 | 0.19 | 0.19 | 0.18 | 0.2 | 0.21 | 0.22 | 0.23 |
|--|------|------|------|------|------|------|------|------|-----|------|------|------|

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

|         |   |   |   |   |   |   |   |   |   |   |   |   |       |
|---------|---|---|---|---|---|---|---|---|---|---|---|---|-------|
| (24a)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (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= | 0.53 | 0.53 | 0.53 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.53 | 0.53 | (24d) |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|-------|

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

|        |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| (25)m= | 0.53 | 0.53 | 0.53 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.53 | 0.53 | (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 |
|-------------------|-----------------|-------------|----------------|-------------------------|-------------|-----------------|------------|
| Doors Type 1      |                 |             | 2.79           | x 1                     | = 2.79      |                 | (26)       |
| Doors Type 2      |                 |             | 1.89           | x 1                     | = 1.89      |                 | (26)       |
| Doors Type 3      |                 |             | 2.84           | x 1                     | = 2.84      |                 | (26)       |
| Windows Type 1    |                 |             | 43.37          | x 1/[1/( 1.4 )+ 0.04] = | 57.5        |                 | (27)       |
| Windows Type 2    |                 |             | 4.81           | x 1/[1/( 1.4 )+ 0.04] = | 6.38        |                 | (27)       |
| Windows Type 3    |                 |             | 23.31          | x 1/[1/( 1.4 )+ 0.04] = | 30.9        |                 | (27)       |
| Windows Type 4    |                 |             | 3.03           | x 1/[1/( 1.4 )+ 0.04] = | 4.02        |                 | (27)       |
| Windows Type 5    |                 |             | 104.6          | x 1/[1/( 1.4 )+ 0.04] = | 138.67      |                 | (27)       |
| Windows Type 6    |                 |             | 4.76           | x 1/[1/( 1.4 )+ 0.04] = | 6.31        |                 | (27)       |
| Windows Type 7    |                 |             | 1.52           | x 1/[1/( 1.4 )+ 0.04] = | 2.02        |                 | (27)       |
| Windows Type 8    |                 |             | 5.58           | x 1/[1/( 1.4 )+ 0.04] = | 7.4         |                 | (27)       |
| Rooflights Type 1 |                 |             | 7.72           | x 1/[1/(1.7) + 0.04] =  | 13.124      |                 | (27b)      |
| Rooflights Type 2 |                 |             | 8.96           | x 1/[1/(1.7) + 0.04] =  | 15.232      |                 | (27b)      |

# TER WorkSheet: New dwelling design stage

|                                        |        |        |         |   |      |   |         |  |  |      |
|----------------------------------------|--------|--------|---------|---|------|---|---------|--|--|------|
| Floor Type 1                           |        |        | 127.44  | x | 0.13 | = | 16.5672 |  |  | (28) |
| Floor Type 2                           |        |        | 385.25  | x | 0.13 | = | 50.0825 |  |  | (28) |
| Floor Type 3                           |        |        | 20.04   | x | 0.13 | = | 2.6052  |  |  | (28) |
| Floor Type 4                           |        |        | 44.22   | x | 0.13 | = | 5.7486  |  |  | (28) |
| Walls Type1                            | 307.35 | 0      | 307.35  | x | 0.18 | = | 55.32   |  |  | (29) |
| Walls Type2                            | 958.47 | 182.49 | 775.98  | x | 0.18 | = | 139.68  |  |  | (29) |
| Walls Type3                            | 34.74  | 1.89   | 32.85   | x | 0.18 | = | 5.91    |  |  | (29) |
| Walls Type4                            | 118.69 | 0      | 118.69  | x | 0.18 | = | 21.36   |  |  | (29) |
| Walls Type5                            | 39.42  | 14.12  | 25.3    | x | 0.18 | = | 4.55    |  |  | (29) |
| Roof Type1                             | 42.14  | 0      | 42.14   | x | 0.13 | = | 5.48    |  |  | (30) |
| Roof Type2                             | 63.68  | 7.72   | 55.96   | x | 0.13 | = | 7.27    |  |  | (30) |
| Roof Type3                             | 45.09  | 0      | 45.09   | x | 0.13 | = | 5.86    |  |  | (30) |
| Roof Type4                             | 11.44  | 0      | 11.44   | x | 0.13 | = | 1.49    |  |  | (30) |
| Roof Type5                             | 82.04  | 0      | 82.04   | x | 0.13 | = | 10.67   |  |  | (30) |
| Roof Type6                             | 112.03 | 0      | 112.03  | x | 0.13 | = | 14.56   |  |  | (30) |
| Roof Type7                             | 20.24  | 0      | 20.24   | x | 0.13 | = | 2.63    |  |  | (30) |
| Roof Type8                             | 112.03 | 8.96   | 103.07  | x | 0.13 | = | 13.4    |  |  | (30) |
| Roof Type9                             | 191.38 | 0      | 191.38  | x | 0.13 | = | 24.88   |  |  | (30) |
| Total area of elements, m <sup>2</sup> |        |        | 2715.69 |   |      |   |         |  |  | (31) |

\* for windows and roof windows, use effective window U-value calculated using formula  $1/[(1/U\text{-value})+0.04]$  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) =                  | 675.34    | (33) |
| Heat capacity Cm = S(A x k)                                    | ((28)...(30) + (32) + (32a)...(32e) = | 163815.52 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m <sup>2</sup> K | 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 | 107.48 | (36) |
|---------------------------------------------------------|--------|------|

if details of thermal bridging are not known (36) = 0.05 x (31)

|                        |               |        |      |
|------------------------|---------------|--------|------|
| Total fabric heat loss | (33) + (36) = | 782.82 | (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= | 1060.16 | 1057.67 | 1055.23 | 1043.78 | 1041.64 | 1031.66 | 1031.66 | 1029.82 | 1035.51 | 1041.64 | 1045.97 | 1050.5 | (38) |

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

|                                          |         |         |         |        |         |         |         |         |         |         |         |         |         |      |
|------------------------------------------|---------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (39)m=                                   | 1842.98 | 1840.49 | 1838.05 | 1826.6 | 1824.46 | 1814.49 | 1814.49 | 1812.64 | 1818.33 | 1824.46 | 1828.79 | 1833.33 |         |      |
| Average = Sum(39) <sub>1...12</sub> /12= |         |         |         |        |         |         |         |         |         |         |         |         | 1826.59 | (39) |

|                                               |                     |  |
|-----------------------------------------------|---------------------|--|
| Heat loss parameter (HLP), W/m <sup>2</sup> K | (40)m = (39)m ÷ (4) |  |
|-----------------------------------------------|---------------------|--|

|                                          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| (40)m=                                   | 1.06 | 1.06 | 1.06 | 1.05 | 1.05 | 1.04 | 1.04 | 1.04 | 1.05 | 1.05 | 1.05 | 1.06 |      |      |
| Average = Sum(40) <sub>1...12</sub> /12= |      |      |      |      |      |      |      |      |      |      |      |      | 1.05 | (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 | 5 | (42) |
|----------------------|---|------|

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)<sup>2</sup>)] + 0.0013 x (TFA -13.9)

Stroma FFA SAP 12.9, Version: 1.0.5.16 (SAP 9.92) - <http://www.stroma.com>

|                                                                             |        |      |
|-----------------------------------------------------------------------------|--------|------|
| Annual average hot water usage in litres per day Vd average = (25 x N) + 36 | 152.96 | (43) |
|-----------------------------------------------------------------------------|--------|------|

# TER WorkSheet: New dwelling design stage

Energy content of hot water used - calculated monthly =  $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$  kWh/month (see Tables 1b, 1c, 1d)

|                                     |        |        |        |        |        |        |        |        |        |        |        |        |         |      |
|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| (45)m=                              | 249.51 | 218.22 | 225.19 | 196.32 | 188.38 | 162.56 | 150.63 | 172.85 | 174.92 | 203.85 | 222.52 | 241.64 |         |      |
| Total = Sum(45) <sub>1...12</sub> = |        |        |        |        |        |        |        |        |        |        |        |        | 2406.59 | (45) |

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| (46)m= | 37.43 | 32.73 | 33.78 | 29.45 | 28.26 | 24.38 | 22.59 | 25.93 | 26.24 | 30.58 | 33.38 | 36.25 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

Water storage loss:

|                                                                                 |     |      |
|---------------------------------------------------------------------------------|-----|------|
| Storage volume (litres) including any solar or WWHRS storage within same vessel | 150 | (47) |
|---------------------------------------------------------------------------------|-----|------|

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

|                                                               |      |      |
|---------------------------------------------------------------|------|------|
| a) If manufacturer's declared loss factor is known (kWh/day): | 1.39 | (48) |
|---------------------------------------------------------------|------|------|

|                                  |      |      |
|----------------------------------|------|------|
| Temperature factor from Table 2b | 0.54 | (49) |
|----------------------------------|------|------|

|                                          |               |      |      |
|------------------------------------------|---------------|------|------|
| Energy lost from water storage, kWh/year | (48) x (49) = | 0.75 | (50) |
|------------------------------------------|---------------|------|------|

b) If manufacturer's declared cylinder loss factor is not known:

|                                                            |   |      |
|------------------------------------------------------------|---|------|
| Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51) |
|------------------------------------------------------------|---|------|

If community heating see section 4.3

|                             |   |      |
|-----------------------------|---|------|
| Volume factor from Table 2a | 0 | (52) |
|-----------------------------|---|------|

|                                  |   |      |
|----------------------------------|---|------|
| Temperature factor from Table 2b | 0 | (53) |
|----------------------------------|---|------|

|                                          |                             |   |      |
|------------------------------------------|-----------------------------|---|------|
| Energy lost from water storage, kWh/year | (47) x (51) x (52) x (53) = | 0 | (54) |
|------------------------------------------|-----------------------------|---|------|

|                            |      |      |
|----------------------------|------|------|
| Enter (50) or (54) in (55) | 0.75 | (55) |
|----------------------------|------|------|

Water storage loss calculated for each month ((56)m = (55) x (41)m)

|        |       |       |       |       |       |       |       |       |       |       |       |       |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| (56)m= | 23.33 | 21.07 | 23.33 | 22.58 | 23.33 | 22.58 | 23.33 | 23.33 | 22.58 | 23.33 | 22.58 | 23.33 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

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= | 23.33 | 21.07 | 23.33 | 22.58 | 23.33 | 22.58 | 23.33 | 23.33 | 22.58 | 23.33 | 22.58 | 23.33 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

|                                            |   |      |
|--------------------------------------------|---|------|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |
|--------------------------------------------|---|------|

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

|        |       |       |       |       |       |       |       |       |       |       |       |       |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

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

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

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

|        |        |        |        |        |        |        |        |        |        |        |        |        |  |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| (62)m= | 296.11 | 260.31 | 271.78 | 241.42 | 234.97 | 207.65 | 197.23 | 219.45 | 220.01 | 250.44 | 267.61 | 288.23 |  |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

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 |  |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|--|

Output from water heater

|                                                     |        |        |        |        |        |        |        |        |        |        |        |        |         |      |
|-----------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| (64)m=                                              | 296.11 | 260.31 | 271.78 | 241.42 | 234.97 | 207.65 | 197.23 | 219.45 | 220.01 | 250.44 | 267.61 | 288.23 |         |      |
| Output from water heater (annual) <sub>1...12</sub> |        |        |        |        |        |        |        |        |        |        |        |        | 2955.21 | (64) |

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

|        |        |        |        |        |       |       |       |       |       |        |        |        |  |
|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|--------|--------|--------|--|
| (65)m= | 120.24 | 106.23 | 112.15 | 101.35 | 99.91 | 90.12 | 87.36 | 94.75 | 94.23 | 105.06 | 110.06 | 117.62 |  |
|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|--------|--------|--------|--|

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 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

# TER WorkSheet: New dwelling design stage

(66)m= 

|        |        |        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (66)

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

(67)m= 

|        |       |      |       |       |       |       |       |       |        |       |        |
|--------|-------|------|-------|-------|-------|-------|-------|-------|--------|-------|--------|
| 129.02 | 114.6 | 93.2 | 70.56 | 52.74 | 44.53 | 48.11 | 62.54 | 83.94 | 106.58 | 124.4 | 132.61 |
|--------|-------|------|-------|-------|-------|-------|-------|-------|--------|-------|--------|

 (67)

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

(68)m= 

|        |         |         |         |         |         |        |        |        |         |         |         |
|--------|---------|---------|---------|---------|---------|--------|--------|--------|---------|---------|---------|
| 1307.5 | 1321.06 | 1286.87 | 1214.09 | 1122.21 | 1035.85 | 978.16 | 964.59 | 998.78 | 1071.57 | 1163.45 | 1249.81 |
|--------|---------|---------|---------|---------|---------|--------|--------|--------|---------|---------|---------|

 (68)

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

(69)m= 

|    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|
| 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
|----|----|----|----|----|----|----|----|----|----|----|----|

 (69)

Pumps and fans gains (Table 5a)

(70)m= 

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|

 (70)

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

(71)m= 

|         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

 (71)

Water heating gains (Table 5)

(72)m= 

|        |        |        |        |        |        |        |        |        |       |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|
| 161.61 | 158.08 | 150.74 | 140.77 | 134.29 | 125.17 | 117.42 | 127.35 | 130.88 | 141.2 | 152.86 | 158.09 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|

 (72)

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

(73)m= 

|         |         |         |         |         |         |        |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|---------|---------|
| 1699.13 | 1694.74 | 1631.82 | 1526.41 | 1410.24 | 1306.55 | 1244.7 | 1255.49 | 1314.61 | 1420.36 | 1541.71 | 1641.51 |
|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|---------|---------|

 (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<br>Table 6d |      |   | Area<br>m <sup>2</sup> | Flux<br>Table 6a |       |   | g_<br>Table 6b | FF<br>Table 6c |     |   | Gains<br>(W) |      |
|--------------|---------------------------|------|---|------------------------|------------------|-------|---|----------------|----------------|-----|---|--------------|------|
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 10.63 | x | 0.63           | x              | 0.7 | = | 75.75        | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 10.63 | x | 0.63           | x              | 0.7 | = | 9.85         | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 20.32 | x | 0.63           | x              | 0.7 | = | 144.76       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 20.32 | x | 0.63           | x              | 0.7 | = | 18.82        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 34.53 | x | 0.63           | x              | 0.7 | = | 245.99       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 34.53 | x | 0.63           | x              | 0.7 | = | 31.98        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 55.46 | x | 0.63           | x              | 0.7 | = | 395.12       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 55.46 | x | 0.63           | x              | 0.7 | = | 51.36        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 74.72 | x | 0.63           | x              | 0.7 | = | 532.26       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 74.72 | x | 0.63           | x              | 0.7 | = | 69.19        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 79.99 | x | 0.63           | x              | 0.7 | = | 569.8        | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 79.99 | x | 0.63           | x              | 0.7 | = | 74.07        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 74.68 | x | 0.63           | x              | 0.7 | = | 531.98       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 74.68 | x | 0.63           | x              | 0.7 | = | 69.15        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 59.25 | x | 0.63           | x              | 0.7 | = | 422.06       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 59.25 | x | 0.63           | x              | 0.7 | = | 54.86        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 41.52 | x | 0.63           | x              | 0.7 | = | 295.76       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 41.52 | x | 0.63           | x              | 0.7 | = | 38.44        | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 24.19 | x | 0.63           | x              | 0.7 | = | 172.32       | (74) |
| North        | 0.9x                      | 0.77 | x | 3.03                   | x                | 24.19 | x | 0.63           | x              | 0.7 | = | 22.4         | (74) |
| North        | 0.9x                      | 0.77 | x | 23.31                  | x                | 13.12 | x | 0.63           | x              | 0.7 | = | 93.45        | (74) |

## TER WorkSheet: New dwelling design stage

|       |      |      |   |       |   |        |   |      |   |     |   |         |      |
|-------|------|------|---|-------|---|--------|---|------|---|-----|---|---------|------|
| North | 0.9x | 0.77 | x | 3.03  | x | 13.12  | x | 0.63 | x | 0.7 | = | 12.15   | (74) |
| North | 0.9x | 0.77 | x | 23.31 | x | 8.86   | x | 0.63 | x | 0.7 | = | 63.15   | (74) |
| North | 0.9x | 0.77 | x | 3.03  | x | 8.86   | x | 0.63 | x | 0.7 | = | 8.21    | (74) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 19.64  | x | 0.63 | x | 0.7 | = | 627.84  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 19.64  | x | 0.63 | x | 0.7 | = | 28.57   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 38.42  | x | 0.63 | x | 0.7 | = | 1228.19 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 38.42  | x | 0.63 | x | 0.7 | = | 55.89   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 63.27  | x | 0.63 | x | 0.7 | = | 2022.66 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 63.27  | x | 0.63 | x | 0.7 | = | 92.04   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 92.28  | x | 0.63 | x | 0.7 | = | 2949.93 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 92.28  | x | 0.63 | x | 0.7 | = | 134.24  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 113.09 | x | 0.63 | x | 0.7 | = | 3615.25 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 113.09 | x | 0.63 | x | 0.7 | = | 164.52  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 115.77 | x | 0.63 | x | 0.7 | = | 3700.85 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 115.77 | x | 0.63 | x | 0.7 | = | 168.41  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 110.22 | x | 0.63 | x | 0.7 | = | 3523.36 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 110.22 | x | 0.63 | x | 0.7 | = | 160.34  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 94.68  | x | 0.63 | x | 0.7 | = | 3026.51 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 94.68  | x | 0.63 | x | 0.7 | = | 137.73  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 73.59  | x | 0.63 | x | 0.7 | = | 2352.44 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 73.59  | x | 0.63 | x | 0.7 | = | 107.05  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 45.59  | x | 0.63 | x | 0.7 | = | 1457.35 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 45.59  | x | 0.63 | x | 0.7 | = | 66.32   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 24.49  | x | 0.63 | x | 0.7 | = | 782.85  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 24.49  | x | 0.63 | x | 0.7 | = | 35.62   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 16.15  | x | 0.63 | x | 0.7 | = | 516.31  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 16.15  | x | 0.63 | x | 0.7 | = | 23.5    | (76) |
| South | 0.9x | 0.77 | x | 1.52  | x | 46.75  | x | 0.63 | x | 0.7 | = | 21.72   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 46.75  | x | 0.63 | x | 0.7 | = | 79.73   | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 76.57  | x | 0.63 | x | 0.7 | = | 35.57   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 76.57  | x | 0.63 | x | 0.7 | = | 130.57  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 97.53  | x | 0.63 | x | 0.7 | = | 45.31   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 97.53  | x | 0.63 | x | 0.7 | = | 166.33  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 110.23 | x | 0.63 | x | 0.7 | = | 51.21   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 110.23 | x | 0.63 | x | 0.7 | = | 187.99  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 114.87 | x | 0.63 | x | 0.7 | = | 53.36   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 114.87 | x | 0.63 | x | 0.7 | = | 195.89  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 110.55 | x | 0.63 | x | 0.7 | = | 51.35   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 110.55 | x | 0.63 | x | 0.7 | = | 188.52  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 108.01 | x | 0.63 | x | 0.7 | = | 50.17   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 108.01 | x | 0.63 | x | 0.7 | = | 184.19  | (78) |

## TER WorkSheet: New dwelling design stage

|            |      |      |   |       |   |        |   |      |   |     |   |         |      |
|------------|------|------|---|-------|---|--------|---|------|---|-----|---|---------|------|
| South      | 0.9x | 0.77 | x | 1.52  | x | 104.89 | x | 0.63 | x | 0.7 | = | 48.73   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 104.89 | x | 0.63 | x | 0.7 | = | 178.88  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 101.89 | x | 0.63 | x | 0.7 | = | 47.33   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 101.89 | x | 0.63 | x | 0.7 | = | 173.75  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 82.59  | x | 0.63 | x | 0.7 | = | 38.36   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 82.59  | x | 0.63 | x | 0.7 | = | 140.83  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 55.42  | x | 0.63 | x | 0.7 | = | 25.74   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 55.42  | x | 0.63 | x | 0.7 | = | 94.5    | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 40.4   | x | 0.63 | x | 0.7 | = | 18.77   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 40.4   | x | 0.63 | x | 0.7 | = | 68.89   | (78) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 19.64  | x | 0.63 | x | 0.7 | = | 260.32  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 19.64  | x | 0.63 | x | 0.7 | = | 28.87   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 38.42  | x | 0.63 | x | 0.7 | = | 509.24  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 38.42  | x | 0.63 | x | 0.7 | = | 56.48   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 63.27  | x | 0.63 | x | 0.7 | = | 838.65  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 63.27  | x | 0.63 | x | 0.7 | = | 93.01   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 92.28  | x | 0.63 | x | 0.7 | = | 1223.12 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 92.28  | x | 0.63 | x | 0.7 | = | 135.65  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 113.09 | x | 0.63 | x | 0.7 | = | 1498.98 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 113.09 | x | 0.63 | x | 0.7 | = | 166.25  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 115.77 | x | 0.63 | x | 0.7 | = | 1534.47 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 115.77 | x | 0.63 | x | 0.7 | = | 170.18  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 110.22 | x | 0.63 | x | 0.7 | = | 1460.88 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 110.22 | x | 0.63 | x | 0.7 | = | 162.02  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 94.68  | x | 0.63 | x | 0.7 | = | 1254.87 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 94.68  | x | 0.63 | x | 0.7 | = | 139.17  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 73.59  | x | 0.63 | x | 0.7 | = | 975.38  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 73.59  | x | 0.63 | x | 0.7 | = | 108.18  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 45.59  | x | 0.63 | x | 0.7 | = | 604.26  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 45.59  | x | 0.63 | x | 0.7 | = | 67.02   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 24.49  | x | 0.63 | x | 0.7 | = | 324.59  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 24.49  | x | 0.63 | x | 0.7 | = | 36      | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 16.15  | x | 0.63 | x | 0.7 | = | 214.07  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 16.15  | x | 0.63 | x | 0.7 | = | 23.74   | (80) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 26     | x | 0.63 | x | 0.7 | = | 79.67   | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 26     | x | 0.63 | x | 0.7 | = | 92.46   | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 54     | x | 0.63 | x | 0.7 | = | 165.46  | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 54     | x | 0.63 | x | 0.7 | = | 192.04  | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 96     | x | 0.63 | x | 0.7 | = | 294.15  | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 96     | x | 0.63 | x | 0.7 | = | 341.4   | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 150    | x | 0.63 | x | 0.7 | = | 459.61  | (82) |

## TER WorkSheet: New dwelling design stage

|                 |   |   |      |   |     |   |      |   |     |   |        |      |
|-----------------|---|---|------|---|-----|---|------|---|-----|---|--------|------|
| Rooflights 0.9x | 1 | x | 8.96 | x | 150 | x | 0.63 | x | 0.7 | = | 533.43 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 192 | x | 0.63 | x | 0.7 | = | 588.3  | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 192 | x | 0.63 | x | 0.7 | = | 682.79 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 200 | x | 0.63 | x | 0.7 | = | 612.81 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 200 | x | 0.63 | x | 0.7 | = | 711.24 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 189 | x | 0.63 | x | 0.7 | = | 579.11 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 189 | x | 0.63 | x | 0.7 | = | 672.13 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 157 | x | 0.63 | x | 0.7 | = | 481.06 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 157 | x | 0.63 | x | 0.7 | = | 558.33 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 115 | x | 0.63 | x | 0.7 | = | 352.37 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 115 | x | 0.63 | x | 0.7 | = | 408.97 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 66  | x | 0.63 | x | 0.7 | = | 202.23 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 66  | x | 0.63 | x | 0.7 | = | 234.71 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 33  | x | 0.63 | x | 0.7 | = | 101.11 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 33  | x | 0.63 | x | 0.7 | = | 117.36 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 21  | x | 0.63 | x | 0.7 | = | 64.35  | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 21  | x | 0.63 | x | 0.7 | = | 74.68  | (82) |

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

|        |         |         |         |         |         |         |         |        |         |         |         |         |      |
|--------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|---------|------|
| (83)m= | 1304.78 | 2537.02 | 4171.51 | 6121.66 | 7566.79 | 7781.72 | 7393.34 | 6302.2 | 4859.66 | 3005.81 | 1623.37 | 1075.66 | (83) |
|--------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|---------|------|

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

|        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (84)m= | 3003.91 | 4231.77 | 5803.33 | 7648.07 | 8977.03 | 9088.27 | 8638.04 | 7557.69 | 6174.27 | 4426.17 | 3165.08 | 2717.17 | (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= | 1   | 1   | 1   | 1   | 0.98 | 0.93 | 0.81 | 0.88 | 0.99 | 1   | 1   | 1   | (86) |

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

|        |       |      |       |      |       |       |       |       |       |      |       |       |      |
|--------|-------|------|-------|------|-------|-------|-------|-------|-------|------|-------|-------|------|
| (87)m= | 19.47 | 19.6 | 19.85 | 20.2 | 20.55 | 20.82 | 20.95 | 20.91 | 20.65 | 20.2 | 19.78 | 19.46 | (87) |
|--------|-------|------|-------|------|-------|-------|-------|-------|-------|------|-------|-------|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (88)m= | 20.03 | 20.03 | 20.04 | 20.04 | 20.04 | 20.05 | 20.05 | 20.05 | 20.04 | 20.04 | 20.04 | 20.04 | (88) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

|        |   |   |   |   |      |      |      |      |      |   |   |   |      |
|--------|---|---|---|---|------|------|------|------|------|---|---|---|------|
| (89)m= | 1 | 1 | 1 | 1 | 0.98 | 0.88 | 0.68 | 0.78 | 0.98 | 1 | 1 | 1 | (89) |
|--------|---|---|---|---|------|------|------|------|------|---|---|---|------|

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

|        |       |       |      |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (90)m= | 17.94 | 18.13 | 18.5 | 19.01 | 19.52 | 19.89 | 20.02 | 19.99 | 19.66 | 19.01 | 18.39 | 17.92 | (90) |
|--------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

fLA = Living area ÷ (4) = 0.04 (91)

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

|        |    |       |       |       |       |       |       |       |      |       |       |       |      |
|--------|----|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|------|
| (92)m= | 18 | 18.19 | 18.56 | 19.06 | 19.56 | 19.93 | 20.06 | 20.03 | 19.7 | 19.06 | 18.44 | 17.98 | (92) |
|--------|----|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|------|

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

|        |    |       |       |       |       |       |       |       |      |       |       |       |      |
|--------|----|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|------|
| (93)m= | 18 | 18.19 | 18.56 | 19.06 | 19.56 | 19.93 | 20.06 | 20.03 | 19.7 | 19.06 | 18.44 | 17.98 | (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 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

# TER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

|        |   |   |   |   |      |      |      |      |      |   |   |   |      |
|--------|---|---|---|---|------|------|------|------|------|---|---|---|------|
| (94)m= | 1 | 1 | 1 | 1 | 0.97 | 0.87 | 0.69 | 0.78 | 0.97 | 1 | 1 | 1 | (94) |
|--------|---|---|---|---|------|------|------|------|------|---|---|---|------|

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

|        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (95)m= | 3003.88 | 4231.48 | 5800.13 | 7610.62 | 8696.96 | 7903.33 | 5926.72 | 5899.92 | 6006.39 | 4422.49 | 3164.98 | 2717.16 | (95) |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|

Monthly average external temperature from Table 8

|        |     |     |     |     |      |      |      |      |      |      |     |     |      |
|--------|-----|-----|-----|-----|------|------|------|------|------|------|-----|-----|------|
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
|--------|-----|-----|-----|-----|------|------|------|------|------|------|-----|-----|------|

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

|        |          |          |          |          |          |         |         |        |          |          |       |         |      |
|--------|----------|----------|----------|----------|----------|---------|---------|--------|----------|----------|-------|---------|------|
| (97)m= | 25256.75 | 24465.88 | 22157.75 | 18565.22 | 14346.25 | 9673.18 | 6273.06 | 6578.6 | 10184.06 | 15432.13 | 20747 | 25264.4 | (97) |
|--------|----------|----------|----------|----------|----------|---------|---------|--------|----------|----------|-------|---------|------|

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

|        |          |          |          |         |         |   |   |   |   |         |          |          |      |
|--------|----------|----------|----------|---------|---------|---|---|---|---|---------|----------|----------|------|
| (98)m= | 16556.13 | 13597.52 | 12170.07 | 7887.32 | 4203.07 | 0 | 0 | 0 | 0 | 8191.18 | 12659.06 | 16775.14 | (98) |
|--------|----------|----------|----------|---------|---------|---|---|---|---|---------|----------|----------|------|

Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> =

92039.48

Space heating requirement in kWh/m<sup>2</sup>/year

52.98

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

### Space heating:

Fraction of space heat from secondary/supplementary system

0

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1

Efficiency of main space heating system 1

93.5

Efficiency of secondary/supplementary heating system, %

0

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

Space heating requirement (calculated above)

|          |          |          |         |         |   |   |   |   |         |          |          |
|----------|----------|----------|---------|---------|---|---|---|---|---------|----------|----------|
| 16556.13 | 13597.52 | 12170.07 | 7887.32 | 4203.07 | 0 | 0 | 0 | 0 | 8191.18 | 12659.06 | 16775.14 |
|----------|----------|----------|---------|---------|---|---|---|---|---------|----------|----------|

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

|         |         |          |         |         |   |   |   |   |         |         |          |
|---------|---------|----------|---------|---------|---|---|---|---|---------|---------|----------|
| 17707.1 | 14542.8 | 13016.12 | 8435.63 | 4495.26 | 0 | 0 | 0 | 0 | 8760.62 | 13539.1 | 17941.33 |
|---------|---------|----------|---------|---------|---|---|---|---|---------|---------|----------|

Total (kWh/year) =Sum(211)<sub>1...5,10...12</sub> =

98437.95

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

|         |   |   |   |   |   |   |   |   |   |   |   |   |       |
|---------|---|---|---|---|---|---|---|---|---|---|---|---|-------|
| (215)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (215) |
|---------|---|---|---|---|---|---|---|---|---|---|---|---|-------|

Total (kWh/year) =Sum(215)<sub>1...5,10...12</sub> =

0

### Water heating

Output from water heater (calculated above)

|        |        |        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 296.11 | 260.31 | 271.78 | 241.42 | 234.97 | 207.65 | 197.23 | 219.45 | 220.01 | 250.44 | 267.61 | 288.23 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

Efficiency of water heater

79.8

|         |       |       |       |       |       |      |      |      |      |       |       |      |       |
|---------|-------|-------|-------|-------|-------|------|------|------|------|-------|-------|------|-------|
| (217)m= | 90.29 | 90.27 | 90.24 | 90.14 | 89.86 | 79.8 | 79.8 | 79.8 | 79.8 | 90.14 | 90.25 | 90.3 | (217) |
|---------|-------|-------|-------|-------|-------|------|------|------|------|-------|-------|------|-------|

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

|         |        |        |        |        |        |        |        |     |       |        |        |        |       |
|---------|--------|--------|--------|--------|--------|--------|--------|-----|-------|--------|--------|--------|-------|
| (219)m= | 327.96 | 288.36 | 301.19 | 267.82 | 261.48 | 260.21 | 247.15 | 275 | 275.7 | 277.83 | 296.52 | 319.21 | (219) |
|---------|--------|--------|--------|--------|--------|--------|--------|-----|-------|--------|--------|--------|-------|

Total = Sum(219a)<sub>1...12</sub> =

3398.44

### Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

98437.95

Water heating fuel used

3398.44

Electricity for pumps, fans and electric keep-hot

## TER WorkSheet: New dwelling design stage

|                                                                              |                          |           |        |
|------------------------------------------------------------------------------|--------------------------|-----------|--------|
| central heating pump:                                                        |                          | 30        | (230c) |
| boiler with a fan-assisted flue                                              |                          | 45        | (230e) |
| Total electricity for the above, kWh/year                                    | sum of (230a)...(230g) = | 75        | (231)  |
| Electricity for lighting                                                     |                          | 2278.62   | (232)  |
| Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = |                          | 104190.01 | (338)  |

### 12a. CO2 emissions – Individual heating systems including micro-CHP

|                                                   | Energy<br>kWh/year              | Emission factor<br>kg CO2/kWh |   | Emissions<br>kg CO2/year |       |
|---------------------------------------------------|---------------------------------|-------------------------------|---|--------------------------|-------|
| Space heating (main system 1)                     | (211) x                         | 0.216                         | = | 21262.6                  | (261) |
| Space heating (secondary)                         | (215) x                         | 0.519                         | = | 0                        | (263) |
| Water heating                                     | (219) x                         | 0.216                         | = | 734.06                   | (264) |
| Space and water heating                           | (261) + (262) + (263) + (264) = |                               |   | 21996.66                 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x                         | 0.519                         | = | 38.93                    | (267) |
| Electricity for lighting                          | (232) x                         | 0.519                         | = | 1182.6                   | (268) |
| Total CO2, kg/year                                |                                 | sum of (265)...(271) =        |   | 23218.19                 | (272) |
| <b>TER =</b>                                      |                                 |                               |   | 13.37                    | (273) |

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.16  
Printed on 04 July 2022 at 10:54:55

## Project Information:

**Assessed By:** Graham Suttill (STRO032448)

**Building Type:** Detached House

## Dwelling Details:

### NEW DWELLING DESIGN STAGE

Total Floor Area: 1737.16m<sup>2</sup>

**Site Reference :** Guildens

**Plot Reference:** Guildens GSHP Be Green

**Address :** Guildens, Courtenay Avenue, London, N6 4LP

## Client Details:

**Name:** Carnell Warren Associates Ltd

**Address :** Duke St, Woking, GU21 5BA

**This report covers items included within the SAP calculations.  
It is not a complete report of regulations compliance.**

## 1a TER and DER

Fuel for main heating system: Electricity (c), Mains gas (c)

Fuel factor: 1.55 (electricity (c), mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 13.37 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 7.49 kg/m<sup>2</sup> **OK**

## 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 64.6 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 53.4 kWh/m<sup>2</sup> **OK**

## 2 Fabric U-values

| Element       | Average          | Highest          |           |
|---------------|------------------|------------------|-----------|
| External wall | 0.15 (max. 0.30) | 0.15 (max. 0.70) | <b>OK</b> |
| Floor         | 0.13 (max. 0.25) | 0.13 (max. 0.70) | <b>OK</b> |
| Roof          | 0.13 (max. 0.20) | 0.13 (max. 0.35) | <b>OK</b> |
| Openings      | 1.41 (max. 2.00) | 1.60 (max. 3.30) | <b>OK</b> |

## 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

## 3 Air permeability

Air permeability at 50 pascals 3.00 (design value)  
Maximum 10.0 **OK**

## 4 Heating efficiency

Main Heating system: Community heating schemes - Heat pump

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 4.50 kWh/day  
Permitted by DBSCG: 5.88 kWh/day  
Primary pipework insulated: Yes **OK**

## 6 Controls

Space heating controls: Flat rate charging, programmer and at least two room thermostats **OK**  
Hot water controls: Cylinderstat **OK**

# Regulations Compliance Report

## 7 Low energy lights

|                                                     |        |    |
|-----------------------------------------------------|--------|----|
| Percentage of fixed lights with low-energy fittings | 100.0% |    |
| Minimum                                             | 75.0%  | OK |

## 8 Mechanical ventilation

|                                      |      |    |
|--------------------------------------|------|----|
| Continuous supply and extract system |      |    |
| Specific fan power:                  | 0.63 |    |
| Maximum                              | 1.5  | OK |
| MVHR efficiency:                     | 90%  |    |
| Minimum                              | 70%  | OK |

## 9 Summertime temperature

|                                   |                     |    |
|-----------------------------------|---------------------|----|
| Overheating risk (Thames valley): | Not significant     | OK |
| Based on:                         |                     |    |
| Overshading:                      | Average or unknown  |    |
| Windows facing: West              | 43.37m <sup>2</sup> |    |
| Windows facing: West              | 4.81m <sup>2</sup>  |    |
| Windows facing: North             | 23.31m <sup>2</sup> |    |
| Windows facing: North             | 3.03m <sup>2</sup>  |    |
| Windows facing: East              | 104.6m <sup>2</sup> |    |
| Windows facing: East              | 4.76m <sup>2</sup>  |    |
| Windows facing: South             | 1.52m <sup>2</sup>  |    |
| Windows facing: South             | 5.58m <sup>2</sup>  |    |
| Roof windows facing: Horizontal   | 7.72m <sup>2</sup>  |    |
| Roof windows facing: Horizontal   | 8.96m <sup>2</sup>  |    |
| Ventilation rate:                 | 4.00                |    |

## 10 Key features

|                                                 |                                      |
|-------------------------------------------------|--------------------------------------|
| Air permeability                                | 3.0 m <sup>3</sup> /m <sup>2</sup> h |
| Community heating, heat from electric heat pump |                                      |
| Fixed cooling system                            |                                      |

# DER WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Graham Suttill **Stroma Number:** STRO032448  
**Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.5.16

**Property Address:** Guildens GSHP Be Green

**Address :** Guildens, Courtenay Avenue, London, N6 4LP

## 1. Overall dwelling dimensions:

|                                                           | Area(m <sup>2</sup> )                |        | Av. Height(m)                     |                                      | Volume(m <sup>3</sup> )              |
|-----------------------------------------------------------|--------------------------------------|--------|-----------------------------------|--------------------------------------|--------------------------------------|
| Basement                                                  | <input type="text" value="127.44"/>  | (1a) x | <input type="text" value="3.5"/>  | (2a) =                               | <input type="text" value="446.04"/>  |
| Ground floor                                              | <input type="text" value="511.57"/>  | (1b) x | <input type="text" value="3.1"/>  | (2b) =                               | <input type="text" value="1585.87"/> |
| First floor                                               | <input type="text" value="414.14"/>  | (1c) x | <input type="text" value="4.4"/>  | (2c) =                               | <input type="text" value="1822.22"/> |
| Second floor                                              | <input type="text" value="405.13"/>  | (1d) x | <input type="text" value="3.44"/> | (2d) =                               | <input type="text" value="1393.65"/> |
| Third floor                                               | <input type="text" value="278.88"/>  | (1e) x | <input type="text" value="2.83"/> | (2e) =                               | <input type="text" value="789.23"/>  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | <input type="text" value="1737.16"/> | (4)    |                                   |                                      |                                      |
| Dwelling volume                                           |                                      |        |                                   | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | <input type="text" value="6037"/>    |

## 2. Ventilation rate:

|                              | main heating                   | secondary heating | other                          | total                          | m <sup>3</sup> per hour         |
|------------------------------|--------------------------------|-------------------|--------------------------------|--------------------------------|---------------------------------|
| Number of chimneys           | <input type="text" value="0"/> | +                 | <input type="text" value="0"/> | +                              | <input type="text" value="0"/>  |
| Number of open flues         | <input type="text" value="0"/> | +                 | <input type="text" value="0"/> | +                              | <input type="text" value="0"/>  |
| Number of intermittent fans  |                                |                   |                                | <input type="text" value="0"/> | <input type="text" value="0"/>  |
| Number of passive vents      |                                |                   |                                | <input type="text" value="8"/> | <input type="text" value="80"/> |
| Number of flueless gas fires |                                |                   |                                | <input type="text" value="0"/> | <input type="text" value="0"/>  |

## Air changes per hour

|                                                                                                                                                                                                                                                    |                                          |               |                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------|-----------------------------------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =                                                                                                                                                                          | <input type="text" value="80"/>          | ÷ (5) =       | <input type="text" value="0.01"/> |
| <i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>                                                                                                                          |                                          |               |                                   |
| Number of storeys in the dwelling (ns)                                                                                                                                                                                                             |                                          |               | <input type="text" value="0"/>    |
| Additional infiltration                                                                                                                                                                                                                            |                                          | [(9)-1]x0.1 = | <input type="text" value="0"/>    |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction<br><i>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</i> |                                          |               | <input type="text" value="0"/>    |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0                                                                                                                                                                      |                                          |               | <input type="text" value="0"/>    |
| If no draught lobby, enter 0.05, else enter 0                                                                                                                                                                                                      |                                          |               | <input type="text" value="0"/>    |
| Percentage of windows and doors draught stripped                                                                                                                                                                                                   |                                          |               | <input type="text" value="0"/>    |
| Window infiltration                                                                                                                                                                                                                                | 0.25 - [0.2 x (14) ÷ 100] =              |               | <input type="text" value="0"/>    |
| Infiltration rate                                                                                                                                                                                                                                  | (8) + (10) + (11) + (12) + (13) + (15) = |               | <input type="text" value="0"/>    |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area                                                                                                                                                  |                                          |               | <input type="text" value="3"/>    |
| If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)                                                                                                                                                             |                                          |               | <input type="text" value="0.16"/> |
| <i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>                                                                                                                            |                                          |               |                                   |
| Number of sides sheltered                                                                                                                                                                                                                          |                                          |               | <input type="text" value="3"/>    |
| Shelter factor                                                                                                                                                                                                                                     | (20) = 1 - [0.075 x (19)] =              |               | <input type="text" value="0.78"/> |
| Infiltration rate incorporating shelter factor                                                                                                                                                                                                     | (21) = (18) x (20) =                     |               | <input type="text" value="0.13"/> |

# DER WorkSheet: New dwelling design stage

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= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
|--------|-----|---|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|

Wind Factor (22a)m = (22)m ÷ 4

|         |      |      |      |     |      |      |      |      |   |      |      |      |
|---------|------|------|------|-----|------|------|------|------|---|------|------|------|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |
|---------|------|------|------|-----|------|------|------|------|---|------|------|------|

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

|  |      |      |      |      |      |      |      |      |      |      |      |      |
|--|------|------|------|------|------|------|------|------|------|------|------|------|
|  | 0.16 | 0.16 | 0.15 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |
|--|------|------|------|------|------|------|------|------|------|------|------|------|

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) =

76.5 (23c)

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

|         |      |      |      |      |      |      |      |      |      |      |      |      |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|
| (24a)m= | 0.28 | 0.28 | 0.27 | 0.26 | 0.25 | 0.24 | 0.24 | 0.23 | 0.24 | 0.25 | 0.26 | 0.27 |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|

(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= | 0.28 | 0.28 | 0.27 | 0.26 | 0.25 | 0.24 | 0.24 | 0.23 | 0.24 | 0.25 | 0.26 | 0.27 |
|--------|------|------|------|------|------|------|------|------|------|------|------|------|

(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 |
|-------------------|-----------------|-------------|----------------|------------------------|-------------|-----------------|------------|
| Doors Type 1      |                 |             | 2.79           | x 1.6                  | = 4.464     |                 | (26)       |
| Doors Type 2      |                 |             | 1.89           | x 1.6                  | = 3.024     |                 | (26)       |
| Doors Type 3      |                 |             | 2.84           | x 1.6                  | = 4.544     |                 | (26)       |
| Windows Type 1    |                 |             | 43.37          | x1/[1/( 1.4 )+ 0.04] = | 57.5        |                 | (27)       |
| Windows Type 2    |                 |             | 4.81           | x1/[1/( 1.4 )+ 0.04] = | 6.38        |                 | (27)       |
| Windows Type 3    |                 |             | 23.31          | x1/[1/( 1.4 )+ 0.04] = | 30.9        |                 | (27)       |
| Windows Type 4    |                 |             | 3.03           | x1/[1/( 1.4 )+ 0.04] = | 4.02        |                 | (27)       |
| Windows Type 5    |                 |             | 104.6          | x1/[1/( 1.4 )+ 0.04] = | 138.67      |                 | (27)       |
| Windows Type 6    |                 |             | 4.76           | x1/[1/( 1.4 )+ 0.04] = | 6.31        |                 | (27)       |
| Windows Type 7    |                 |             | 1.52           | x1/[1/( 1.4 )+ 0.04] = | 2.02        |                 | (27)       |
| Windows Type 8    |                 |             | 5.58           | x1/[1/( 1.4 )+ 0.04] = | 7.4         |                 | (27)       |
| Rooflights Type 1 |                 |             | 7.72           | x1/[1/(1.4) + 0.04] =  | 10.808      |                 | (27b)      |
| Rooflights Type 2 |                 |             | 8.96           | x1/[1/(1.4) + 0.04] =  | 12.544      |                 | (27b)      |

## DER WorkSheet: New dwelling design stage

|                                        |        |        |         |   |      |   |         |  |  |      |
|----------------------------------------|--------|--------|---------|---|------|---|---------|--|--|------|
| Floor Type 1                           |        |        | 127.44  | x | 0.13 | = | 16.5672 |  |  | (28) |
| Floor Type 2                           |        |        | 385.25  | x | 0.13 | = | 50.0825 |  |  | (28) |
| Floor Type 3                           |        |        | 20.04   | x | 0.13 | = | 2.6052  |  |  | (28) |
| Floor Type 4                           |        |        | 44.22   | x | 0.13 | = | 5.7486  |  |  | (28) |
| Walls Type1                            | 307.35 | 0      | 307.35  | x | 0.15 | = | 46.1    |  |  | (29) |
| Walls Type2                            | 958.47 | 182.49 | 775.98  | x | 0.15 | = | 116.4   |  |  | (29) |
| Walls Type3                            | 34.74  | 1.89   | 32.85   | x | 0.15 | = | 4.93    |  |  | (29) |
| Walls Type4                            | 118.69 | 0      | 118.69  | x | 0.15 | = | 17.8    |  |  | (29) |
| Walls Type5                            | 39.42  | 14.12  | 25.3    | x | 0.15 | = | 3.79    |  |  | (29) |
| Roof Type1                             | 42.14  | 0      | 42.14   | x | 0.13 | = | 5.48    |  |  | (30) |
| Roof Type2                             | 63.68  | 7.72   | 55.96   | x | 0.13 | = | 7.27    |  |  | (30) |
| Roof Type3                             | 45.09  | 0      | 45.09   | x | 0.13 | = | 5.86    |  |  | (30) |
| Roof Type4                             | 11.44  | 0      | 11.44   | x | 0.13 | = | 1.49    |  |  | (30) |
| Roof Type5                             | 82.04  | 0      | 82.04   | x | 0.13 | = | 10.67   |  |  | (30) |
| Roof Type6                             | 112.03 | 0      | 112.03  | x | 0.13 | = | 14.56   |  |  | (30) |
| Roof Type7                             | 20.24  | 0      | 20.24   | x | 0.13 | = | 2.63    |  |  | (30) |
| Roof Type8                             | 112.03 | 8.96   | 103.07  | x | 0.13 | = | 13.4    |  |  | (30) |
| Roof Type9                             | 191.38 | 0      | 191.38  | x | 0.13 | = | 24.88   |  |  | (30) |
| Total area of elements, m <sup>2</sup> |        |        | 2715.69 |   |      |   |         |  |  | (31) |

\* for windows and roof windows, use effective window U-value calculated using formula  $1/[(1/U\text{-value})+0.04]$  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) =                  | 637.61    | (33) |
| Heat capacity Cm = S(A x k)                                    | ((28)...(30) + (32) + (32a)...(32e) = | 163815.52 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m <sup>2</sup> K | 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 | 134.86 | (36) |
|---------------------------------------------------------|--------|------|

if details of thermal bridging are not known (36) = 0.05 x (31)

|                        |               |        |      |
|------------------------|---------------|--------|------|
| Total fabric heat loss | (33) + (36) = | 772.46 | (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= | 555.45 | 549.15 | 542.85 | 511.34 | 505.04 | 473.54 | 473.54 | 467.24 | 486.14 | 505.04 | 517.65 | 530.25 | (38) |

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

|                                          |         |         |         |         |         |      |      |        |        |         |         |         |         |      |
|------------------------------------------|---------|---------|---------|---------|---------|------|------|--------|--------|---------|---------|---------|---------|------|
| (39)m=                                   | 1327.92 | 1321.62 | 1315.32 | 1283.81 | 1277.51 | 1246 | 1246 | 1239.7 | 1258.6 | 1277.51 | 1290.11 | 1302.71 |         |      |
| Average = Sum(39) <sub>1...12</sub> /12= |         |         |         |         |         |      |      |        |        |         |         |         | 1282.23 | (39) |

|                                               |                     |  |
|-----------------------------------------------|---------------------|--|
| Heat loss parameter (HLP), W/m <sup>2</sup> K | (40)m = (39)m ÷ (4) |  |
|-----------------------------------------------|---------------------|--|

|                                          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| (40)m=                                   | 0.76 | 0.76 | 0.76 | 0.74 | 0.74 | 0.72 | 0.72 | 0.71 | 0.72 | 0.74 | 0.74 | 0.75 |      |      |
| Average = Sum(40) <sub>1...12</sub> /12= |      |      |      |      |      |      |      |      |      |      |      |      | 0.74 | (40) |

Number of days in month (Table 1a)

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

### 4. Water heating energy requirement:

kWh/year:

|                      |   |      |
|----------------------|---|------|
| Assumed occupancy, N | 5 | (42) |
|----------------------|---|------|

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)<sup>2</sup>)] + 0.0013 x (TFA -13.9)

Stroma FFA SAP 12.9, Version: 1.0.5.16 (SAP 9.92) - <http://www.stroma.com>

|                                                                             |        |      |
|-----------------------------------------------------------------------------|--------|------|
| Annual average hot water usage in litres per day Vd average = (25 x N) + 36 | 152.96 | (43) |
|-----------------------------------------------------------------------------|--------|------|

# DER WorkSheet: New dwelling design stage

Energy content of hot water used - calculated monthly =  $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$  kWh/month (see Tables 1b, 1c, 1d)

|                                     |        |        |        |        |        |        |        |        |        |        |        |        |         |      |
|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| (45)m=                              | 249.51 | 218.22 | 225.19 | 196.32 | 188.38 | 162.56 | 150.63 | 172.85 | 174.92 | 203.85 | 222.52 | 241.64 |         |      |
| Total = Sum(45) <sub>1...12</sub> = |        |        |        |        |        |        |        |        |        |        |        |        | 2406.59 | (45) |

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| (46)m= | 37.43 | 32.73 | 33.78 | 29.45 | 28.26 | 24.38 | 22.59 | 25.93 | 26.24 | 30.58 | 33.38 | 36.25 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

Water storage loss:

|                                                                                 |     |      |
|---------------------------------------------------------------------------------|-----|------|
| Storage volume (litres) including any solar or WWHRS storage within same vessel | 800 | (47) |
|---------------------------------------------------------------------------------|-----|------|

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

|                                                               |     |      |
|---------------------------------------------------------------|-----|------|
| a) If manufacturer's declared loss factor is known (kWh/day): | 4.5 | (48) |
|---------------------------------------------------------------|-----|------|

|                                  |         |      |
|----------------------------------|---------|------|
| Temperature factor from Table 2b | 0.79299 | (49) |
|----------------------------------|---------|------|

|                                          |               |      |      |
|------------------------------------------|---------------|------|------|
| Energy lost from water storage, kWh/year | (48) x (49) = | 3.57 | (50) |
|------------------------------------------|---------------|------|------|

b) If manufacturer's declared cylinder loss factor is not known:

|                                                            |   |      |
|------------------------------------------------------------|---|------|
| Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51) |
|------------------------------------------------------------|---|------|

If community heating see section 4.3

|                             |   |      |
|-----------------------------|---|------|
| Volume factor from Table 2a | 0 | (52) |
|-----------------------------|---|------|

|                                  |   |      |
|----------------------------------|---|------|
| Temperature factor from Table 2b | 0 | (53) |
|----------------------------------|---|------|

|                                          |                             |   |      |
|------------------------------------------|-----------------------------|---|------|
| Energy lost from water storage, kWh/year | (47) x (51) x (52) x (53) = | 0 | (54) |
|------------------------------------------|-----------------------------|---|------|

|                            |      |      |
|----------------------------|------|------|
| Enter (50) or (54) in (55) | 3.57 | (55) |
|----------------------------|------|------|

Water storage loss calculated for each month ((56)m = (55) x (41)m)

|        |        |       |        |        |        |        |        |        |        |        |        |        |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| (56)m= | 110.62 | 99.92 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

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= | 110.62 | 99.92 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 | 110.62 | 107.05 | 110.62 | 107.05 | 110.62 |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

|                                            |   |      |
|--------------------------------------------|---|------|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |
|--------------------------------------------|---|------|

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

|        |       |       |       |       |       |       |       |       |       |       |       |       |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 |  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|

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

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

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

|        |       |        |        |        |        |        |        |        |        |        |        |        |  |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| (62)m= | 383.4 | 339.15 | 359.07 | 325.89 | 322.26 | 292.12 | 284.52 | 306.74 | 304.48 | 337.73 | 352.08 | 375.52 |  |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

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 |  |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|--|

Output from water heater

|                                                     |       |        |        |        |        |        |        |        |        |        |        |        |         |      |
|-----------------------------------------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| (64)m=                                              | 383.4 | 339.15 | 359.07 | 325.89 | 322.26 | 292.12 | 284.52 | 306.74 | 304.48 | 337.73 | 352.08 | 375.52 |         |      |
| Output from water heater (annual) <sub>1...12</sub> |       |        |        |        |        |        |        |        |        |        |        |        | 3982.97 | (64) |

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

|        |        |       |        |        |        |       |        |        |        |        |        |        |  |
|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--|
| (65)m= | 190.07 | 169.3 | 181.98 | 168.93 | 169.74 | 157.7 | 157.19 | 164.58 | 161.81 | 174.89 | 177.64 | 187.45 |  |
|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--|

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 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

## DER WorkSheet: New dwelling design stage

(66)m= 

|        |        |        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 | 250.01 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (66)

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

(67)m= 

|        |        |       |       |       |       |       |       |      |        |        |        |
|--------|--------|-------|-------|-------|-------|-------|-------|------|--------|--------|--------|
| 125.27 | 111.27 | 90.49 | 68.51 | 51.21 | 43.23 | 46.71 | 60.72 | 81.5 | 103.48 | 120.78 | 128.76 |
|--------|--------|-------|-------|-------|-------|-------|-------|------|--------|--------|--------|

 (67)

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

(68)m= 

|        |         |         |         |         |         |        |        |        |         |         |         |
|--------|---------|---------|---------|---------|---------|--------|--------|--------|---------|---------|---------|
| 1307.5 | 1321.06 | 1286.87 | 1214.09 | 1122.21 | 1035.85 | 978.16 | 964.59 | 998.78 | 1071.57 | 1163.45 | 1249.81 |
|--------|---------|---------|---------|---------|---------|--------|--------|--------|---------|---------|---------|

 (68)

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

(69)m= 

|    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|
| 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
|----|----|----|----|----|----|----|----|----|----|----|----|

 (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= 

|         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 | -200.01 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

 (71)

Water heating gains (Table 5)

(72)m= 

|        |        |       |        |        |        |        |        |        |        |        |        |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 255.47 | 251.94 | 244.6 | 234.63 | 228.15 | 219.03 | 211.28 | 221.21 | 224.74 | 235.06 | 246.72 | 251.95 |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (72)

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

(73)m= 

|         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1786.24 | 1782.27 | 1719.97 | 1615.22 | 1499.57 | 1396.12 | 1334.16 | 1344.53 | 1403.03 | 1508.12 | 1628.96 | 1728.52 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

 (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<br>Table 6d |                                       |      | Area<br>m <sup>2</sup> | Flux<br>Table 6a                       |       |   | g_<br>Table 6b                         | FF<br>Table 6c |   |                                       | Gains<br>(W) |   |                                      |     |   |                                         |        |      |
|--------------|---------------------------|---------------------------------------|------|------------------------|----------------------------------------|-------|---|----------------------------------------|----------------|---|---------------------------------------|--------------|---|--------------------------------------|-----|---|-----------------------------------------|--------|------|
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>10.63</td></tr></table> | 10.63          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>86.57</td></tr></table>  | 86.57  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 10.63        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 86.57        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>10.63</td></tr></table> | 10.63          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>11.25</td></tr></table>  | 11.25  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 10.63        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 11.25        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>20.32</td></tr></table> | 20.32          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>165.44</td></tr></table> | 165.44 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 20.32        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 165.44       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>20.32</td></tr></table> | 20.32          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>21.51</td></tr></table>  | 21.51  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 20.32        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 21.51        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>34.53</td></tr></table> | 34.53          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>281.13</td></tr></table> | 281.13 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 34.53        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 281.13       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>34.53</td></tr></table> | 34.53          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>36.54</td></tr></table>  | 36.54  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 34.53        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 36.54        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>55.46</td></tr></table> | 55.46          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>451.57</td></tr></table> | 451.57 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 55.46        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 451.57       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>55.46</td></tr></table> | 55.46          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>58.7</td></tr></table>   | 58.7   | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 55.46        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 58.7         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>74.72</td></tr></table> | 74.72          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>608.3</td></tr></table>  | 608.3  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.72        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 608.3        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>74.72</td></tr></table> | 74.72          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>79.07</td></tr></table>  | 79.07  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.72        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.07        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>79.99</td></tr></table> | 79.99          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>651.2</td></tr></table>  | 651.2  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.99        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 651.2        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>79.99</td></tr></table> | 79.99          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>84.65</td></tr></table>  | 84.65  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.99        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 84.65        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>74.68</td></tr></table> | 74.68          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>607.98</td></tr></table> | 607.98 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.68        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 607.98       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>74.68</td></tr></table> | 74.68          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>79.03</td></tr></table>  | 79.03  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 74.68        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 79.03        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>59.25</td></tr></table> | 59.25          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>482.36</td></tr></table> | 482.36 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 59.25        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 482.36       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>59.25</td></tr></table> | 59.25          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>62.7</td></tr></table>   | 62.7   | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 59.25        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 62.7         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>41.52</td></tr></table> | 41.52          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>338.01</td></tr></table> | 338.01 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 41.52        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 338.01       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>41.52</td></tr></table> | 41.52          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>43.94</td></tr></table>  | 43.94  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 41.52        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 43.94        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>24.19</td></tr></table> | 24.19          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>196.94</td></tr></table> | 196.94 | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 24.19        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 196.94       |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>3.03</td></tr></table>  | 3.03  | x | <table><tr><td>24.19</td></tr></table> | 24.19          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>25.6</td></tr></table>   | 25.6   | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 3.03         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 24.19        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 25.6         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>23.31</td></tr></table> | 23.31 | x | <table><tr><td>13.12</td></tr></table> | 13.12          | x | <table><tr><td>0.63</td></tr></table> | 0.63         | x | <table><tr><td>0.8</td></tr></table> | 0.8 | = | <table><tr><td>106.8</td></tr></table>  | 106.8  | (74) |
| 0.77         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 23.31        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 13.12        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.63         |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 0.8          |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |
| 106.8        |                           |                                       |      |                        |                                        |       |   |                                        |                |   |                                       |              |   |                                      |     |   |                                         |        |      |

## DER WorkSheet: New dwelling design stage

|       |      |      |   |       |   |        |   |      |   |     |   |         |      |
|-------|------|------|---|-------|---|--------|---|------|---|-----|---|---------|------|
| North | 0.9x | 0.77 | x | 3.03  | x | 13.12  | x | 0.63 | x | 0.8 | = | 13.88   | (74) |
| North | 0.9x | 0.77 | x | 23.31 | x | 8.86   | x | 0.63 | x | 0.8 | = | 72.17   | (74) |
| North | 0.9x | 0.77 | x | 3.03  | x | 8.86   | x | 0.63 | x | 0.8 | = | 9.38    | (74) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 19.64  | x | 0.63 | x | 0.8 | = | 717.53  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 19.64  | x | 0.63 | x | 0.8 | = | 32.65   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 38.42  | x | 0.63 | x | 0.8 | = | 1403.65 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 38.42  | x | 0.63 | x | 0.8 | = | 63.88   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 63.27  | x | 0.63 | x | 0.8 | = | 2311.61 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 63.27  | x | 0.63 | x | 0.8 | = | 105.19  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 92.28  | x | 0.63 | x | 0.8 | = | 3371.35 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 92.28  | x | 0.63 | x | 0.8 | = | 153.42  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 113.09 | x | 0.63 | x | 0.8 | = | 4131.71 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 113.09 | x | 0.63 | x | 0.8 | = | 188.02  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 115.77 | x | 0.63 | x | 0.8 | = | 4229.54 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 115.77 | x | 0.63 | x | 0.8 | = | 192.47  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 110.22 | x | 0.63 | x | 0.8 | = | 4026.7  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 110.22 | x | 0.63 | x | 0.8 | = | 183.24  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 94.68  | x | 0.63 | x | 0.8 | = | 3458.87 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 94.68  | x | 0.63 | x | 0.8 | = | 157.4   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 73.59  | x | 0.63 | x | 0.8 | = | 2688.5  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 73.59  | x | 0.63 | x | 0.8 | = | 122.34  | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 45.59  | x | 0.63 | x | 0.8 | = | 1665.55 | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 45.59  | x | 0.63 | x | 0.8 | = | 75.79   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 24.49  | x | 0.63 | x | 0.8 | = | 894.68  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 24.49  | x | 0.63 | x | 0.8 | = | 40.71   | (76) |
| East  | 0.9x | 0.77 | x | 104.6 | x | 16.15  | x | 0.63 | x | 0.8 | = | 590.07  | (76) |
| East  | 0.9x | 0.77 | x | 4.76  | x | 16.15  | x | 0.63 | x | 0.8 | = | 26.85   | (76) |
| South | 0.9x | 0.77 | x | 1.52  | x | 46.75  | x | 0.63 | x | 0.8 | = | 24.82   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 46.75  | x | 0.63 | x | 0.8 | = | 91.12   | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 76.57  | x | 0.63 | x | 0.8 | = | 40.65   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 76.57  | x | 0.63 | x | 0.8 | = | 149.23  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 97.53  | x | 0.63 | x | 0.8 | = | 51.78   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 97.53  | x | 0.63 | x | 0.8 | = | 190.09  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 110.23 | x | 0.63 | x | 0.8 | = | 58.52   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 110.23 | x | 0.63 | x | 0.8 | = | 214.84  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 114.87 | x | 0.63 | x | 0.8 | = | 60.98   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 114.87 | x | 0.63 | x | 0.8 | = | 223.88  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 110.55 | x | 0.63 | x | 0.8 | = | 58.69   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 110.55 | x | 0.63 | x | 0.8 | = | 215.45  | (78) |
| South | 0.9x | 0.77 | x | 1.52  | x | 108.01 | x | 0.63 | x | 0.8 | = | 57.34   | (78) |
| South | 0.9x | 0.77 | x | 5.58  | x | 108.01 | x | 0.63 | x | 0.8 | = | 210.51  | (78) |

## DER WorkSheet: New dwelling design stage

|            |      |      |   |       |   |        |   |      |   |     |   |         |      |
|------------|------|------|---|-------|---|--------|---|------|---|-----|---|---------|------|
| South      | 0.9x | 0.77 | x | 1.52  | x | 104.89 | x | 0.63 | x | 0.8 | = | 55.69   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 104.89 | x | 0.63 | x | 0.8 | = | 204.43  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 101.89 | x | 0.63 | x | 0.8 | = | 54.09   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 101.89 | x | 0.63 | x | 0.8 | = | 198.57  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 82.59  | x | 0.63 | x | 0.8 | = | 43.84   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 82.59  | x | 0.63 | x | 0.8 | = | 160.95  | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 55.42  | x | 0.63 | x | 0.8 | = | 29.42   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 55.42  | x | 0.63 | x | 0.8 | = | 108     | (78) |
| South      | 0.9x | 0.77 | x | 1.52  | x | 40.4   | x | 0.63 | x | 0.8 | = | 21.45   | (78) |
| South      | 0.9x | 0.77 | x | 5.58  | x | 40.4   | x | 0.63 | x | 0.8 | = | 78.73   | (78) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 19.64  | x | 0.63 | x | 0.8 | = | 297.51  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 19.64  | x | 0.63 | x | 0.8 | = | 33      | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 38.42  | x | 0.63 | x | 0.8 | = | 581.99  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 38.42  | x | 0.63 | x | 0.8 | = | 64.55   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 63.27  | x | 0.63 | x | 0.8 | = | 958.46  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 63.27  | x | 0.63 | x | 0.8 | = | 106.3   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 92.28  | x | 0.63 | x | 0.8 | = | 1397.85 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 92.28  | x | 0.63 | x | 0.8 | = | 155.03  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 113.09 | x | 0.63 | x | 0.8 | = | 1713.12 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 113.09 | x | 0.63 | x | 0.8 | = | 190     | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 115.77 | x | 0.63 | x | 0.8 | = | 1753.68 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 115.77 | x | 0.63 | x | 0.8 | = | 194.49  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 110.22 | x | 0.63 | x | 0.8 | = | 1669.58 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 110.22 | x | 0.63 | x | 0.8 | = | 185.17  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 94.68  | x | 0.63 | x | 0.8 | = | 1434.14 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 94.68  | x | 0.63 | x | 0.8 | = | 159.06  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 73.59  | x | 0.63 | x | 0.8 | = | 1114.72 | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 73.59  | x | 0.63 | x | 0.8 | = | 123.63  | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 45.59  | x | 0.63 | x | 0.8 | = | 690.58  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 45.59  | x | 0.63 | x | 0.8 | = | 76.59   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 24.49  | x | 0.63 | x | 0.8 | = | 370.96  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 24.49  | x | 0.63 | x | 0.8 | = | 41.14   | (80) |
| West       | 0.9x | 0.77 | x | 43.37 | x | 16.15  | x | 0.63 | x | 0.8 | = | 244.66  | (80) |
| West       | 0.9x | 0.77 | x | 4.81  | x | 16.15  | x | 0.63 | x | 0.8 | = | 27.13   | (80) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 26     | x | 0.63 | x | 0.8 | = | 91.05   | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 26     | x | 0.63 | x | 0.8 | = | 105.67  | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 54     | x | 0.63 | x | 0.8 | = | 189.1   | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 54     | x | 0.63 | x | 0.8 | = | 219.47  | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 96     | x | 0.63 | x | 0.8 | = | 336.17  | (82) |
| Rooflights | 0.9x | 1    | x | 8.96  | x | 96     | x | 0.63 | x | 0.8 | = | 390.17  | (82) |
| Rooflights | 0.9x | 1    | x | 7.72  | x | 150    | x | 0.63 | x | 0.8 | = | 525.27  | (82) |

## DER WorkSheet: New dwelling design stage

|                 |   |   |      |   |     |   |      |   |     |   |        |      |
|-----------------|---|---|------|---|-----|---|------|---|-----|---|--------|------|
| Rooflights 0.9x | 1 | x | 8.96 | x | 150 | x | 0.63 | x | 0.8 | = | 609.64 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 192 | x | 0.63 | x | 0.8 | = | 672.34 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 192 | x | 0.63 | x | 0.8 | = | 780.34 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 200 | x | 0.63 | x | 0.8 | = | 700.36 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 200 | x | 0.63 | x | 0.8 | = | 812.85 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 189 | x | 0.63 | x | 0.8 | = | 661.84 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 189 | x | 0.63 | x | 0.8 | = | 768.14 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 157 | x | 0.63 | x | 0.8 | = | 549.78 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 157 | x | 0.63 | x | 0.8 | = | 638.09 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 115 | x | 0.63 | x | 0.8 | = | 402.71 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 115 | x | 0.63 | x | 0.8 | = | 467.39 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 66  | x | 0.63 | x | 0.8 | = | 231.12 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 66  | x | 0.63 | x | 0.8 | = | 268.24 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 33  | x | 0.63 | x | 0.8 | = | 115.56 | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 33  | x | 0.63 | x | 0.8 | = | 134.12 | (82) |
| Rooflights 0.9x | 1 | x | 7.72 | x | 21  | x | 0.63 | x | 0.8 | = | 73.54  | (82) |
| Rooflights 0.9x | 1 | x | 8.96 | x | 21  | x | 0.63 | x | 0.8 | = | 85.35  | (82) |

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

|        |         |         |         |         |         |         |         |         |        |         |         |         |      |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|------|
| (83)m= | 1491.17 | 2899.45 | 4767.44 | 6996.18 | 8647.76 | 8893.39 | 8449.53 | 7202.52 | 5553.9 | 3435.21 | 1855.28 | 1229.33 | (83) |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|------|

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

|        |         |         |         |        |          |          |         |         |         |         |         |         |      |
|--------|---------|---------|---------|--------|----------|----------|---------|---------|---------|---------|---------|---------|------|
| (84)m= | 3277.42 | 4681.73 | 6487.41 | 8611.4 | 10147.33 | 10289.51 | 9783.69 | 8547.05 | 6956.92 | 4943.33 | 3484.24 | 2957.84 | (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= | 1   | 1   | 1   | 0.99 | 0.94 | 0.75 | 0.56 | 0.66 | 0.95 | 1   | 1   | 1   | (86) |

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

|        |      |       |       |       |       |       |    |       |       |       |       |      |      |
|--------|------|-------|-------|-------|-------|-------|----|-------|-------|-------|-------|------|------|
| (87)m= | 19.9 | 20.03 | 20.27 | 20.59 | 20.86 | 20.98 | 21 | 20.99 | 20.88 | 20.51 | 20.16 | 19.9 | (87) |
|--------|------|-------|-------|-------|-------|-------|----|-------|-------|-------|-------|------|------|

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

|        |       |       |       |       |       |       |       |       |       |       |      |      |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|
| (88)m= | 20.28 | 20.29 | 20.29 | 20.31 | 20.31 | 20.33 | 20.33 | 20.33 | 20.32 | 20.31 | 20.3 | 20.3 | (88) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|

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

|        |   |   |   |      |      |      |      |      |      |   |   |   |      |
|--------|---|---|---|------|------|------|------|------|------|---|---|---|------|
| (89)m= | 1 | 1 | 1 | 0.99 | 0.91 | 0.68 | 0.47 | 0.57 | 0.93 | 1 | 1 | 1 | (89) |
|--------|---|---|---|------|------|------|------|------|------|---|---|---|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (90)m= | 19.24 | 19.38 | 19.61 | 19.95 | 20.21 | 20.32 | 20.33 | 20.33 | 20.24 | 19.87 | 19.51 | 19.25 | (90) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

fLA = Living area ÷ (4) = 0.04 (91)

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

|        |       |      |       |       |       |       |       |       |       |      |       |       |      |
|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|
| (92)m= | 19.27 | 19.4 | 19.64 | 19.98 | 20.23 | 20.34 | 20.35 | 20.35 | 20.26 | 19.9 | 19.54 | 19.27 | (92) |
|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|

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

|        |       |      |       |       |       |       |       |       |       |      |       |       |      |
|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|
| (93)m= | 19.17 | 19.3 | 19.54 | 19.88 | 20.13 | 20.24 | 20.25 | 20.25 | 20.16 | 19.8 | 19.44 | 19.17 | (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 |  |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|

## DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

|        |   |   |   |      |     |      |      |      |      |   |   |   |      |
|--------|---|---|---|------|-----|------|------|------|------|---|---|---|------|
| (94)m= | 1 | 1 | 1 | 0.99 | 0.9 | 0.67 | 0.46 | 0.56 | 0.92 | 1 | 1 | 1 | (94) |
|--------|---|---|---|------|-----|------|------|------|------|---|---|---|------|

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

|        |         |         |         |        |         |         |         |         |         |         |         |         |      |
|--------|---------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (95)m= | 3277.41 | 4681.55 | 6483.41 | 8516.2 | 9174.61 | 6896.98 | 4543.42 | 4751.25 | 6382.66 | 4938.16 | 3484.19 | 2957.84 | (95) |
|--------|---------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|------|

Monthly average external temperature from Table 8

|        |     |     |     |     |      |      |      |      |      |      |     |     |      |
|--------|-----|-----|-----|-----|------|------|------|------|------|------|-----|-----|------|
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
|--------|-----|-----|-----|-----|------|------|------|------|------|------|-----|-----|------|

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

|        |          |          |          |          |          |         |         |         |         |          |          |          |      |
|--------|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|------|
| (97)m= | 19743.46 | 19036.25 | 17150.54 | 14091.28 | 10775.23 | 7032.91 | 4551.54 | 4778.54 | 7632.91 | 11752.56 | 15918.34 | 19506.22 | (97) |
|--------|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|----------|------|

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

|                                                               |          |         |         |         |         |   |   |   |   |         |         |          |      |
|---------------------------------------------------------------|----------|---------|---------|---------|---------|---|---|---|---|---------|---------|----------|------|
| (98)m=                                                        | 12250.75 | 9646.36 | 7936.35 | 4014.06 | 1190.86 | 0 | 0 | 0 | 0 | 5069.91 | 8952.59 | 12311.99 |      |
| Total per year (kWh/year) = Sum(98) <sub>1...5,9...12</sub> = |          |         |         |         |         |   |   |   |   |         |         | 61372.87 | (98) |

Space heating requirement in kWh/m<sup>2</sup>/year

|       |      |
|-------|------|
| 35.33 | (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 | 11712.41 | 9220.4 | 9421.71 | 0 | 0 | 0 | 0 | (100) |
|---------|---|---|---|---|---|----------|--------|---------|---|---|---|---|-------|

Utilisation factor for loss hm

|         |   |   |   |   |   |     |      |      |   |   |   |   |       |
|---------|---|---|---|---|---|-----|------|------|---|---|---|---|-------|
| (101)m= | 0 | 0 | 0 | 0 | 0 | 0.9 | 0.96 | 0.91 | 0 | 0 | 0 | 0 | (101) |
|---------|---|---|---|---|---|-----|------|------|---|---|---|---|-------|

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

|         |   |   |   |   |   |          |         |        |   |   |   |   |       |
|---------|---|---|---|---|---|----------|---------|--------|---|---|---|---|-------|
| (102)m= | 0 | 0 | 0 | 0 | 0 | 10521.52 | 8820.29 | 8612.4 | 0 | 0 | 0 | 0 | (102) |
|---------|---|---|---|---|---|----------|---------|--------|---|---|---|---|-------|

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

|         |   |   |   |   |   |          |          |          |   |   |   |   |       |
|---------|---|---|---|---|---|----------|----------|----------|---|---|---|---|-------|
| (103)m= | 0 | 0 | 0 | 0 | 0 | 12182.57 | 11592.66 | 10200.69 | 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 x (98)m

|                    |   |   |   |   |   |         |         |         |   |   |   |         |       |
|--------------------|---|---|---|---|---|---------|---------|---------|---|---|---|---------|-------|
| (104)m=            | 0 | 0 | 0 | 0 | 0 | 1195.96 | 2062.65 | 1181.69 | 0 | 0 | 0 | 0       |       |
| Total = Sum(104) = |   |   |   |   |   |         |         |         |   |   |   | 4440.29 | (104) |

Cooled fraction

f C = cooled area ÷ (4) =

|   |       |
|---|-------|
| 1 | (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 x (105) x (106)m

|         |   |   |   |   |   |        |        |       |   |   |   |   |  |
|---------|---|---|---|---|---|--------|--------|-------|---|---|---|---|--|
| (107)m= | 0 | 0 | 0 | 0 | 0 | 298.96 | 515.61 | 295.4 | 0 | 0 | 0 | 0 |  |
|---------|---|---|---|---|---|--------|--------|-------|---|---|---|---|--|

Total = Sum(107) =

|         |       |
|---------|-------|
| 1109.97 | (107) |
|---------|-------|

Space cooling requirement in kWh/m<sup>2</sup>/year

(107) ÷ (4) =

|      |       |
|------|-------|
| 0.64 | (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

|     |        |
|-----|--------|
| 0.9 | (303a) |
|-----|--------|

Fraction of community heat from heat source 2

|     |        |
|-----|--------|
| 0.1 | (303b) |
|-----|--------|

## DER WorkSheet: New dwelling design stage

|                                                                                                                                         |                                              |                 |        |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------|--------|
| Fraction of total space heat from Community heat pump                                                                                   | (302) x (303a) =                             | 0.9             | (304a) |
| Fraction of total space heat from community heat source 2                                                                               | (302) x (303b) =                             | 0.1             | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system                                                       |                                              | 1.05            | (305)  |
| Distribution loss factor (Table 12c) for community heating system                                                                       |                                              | 1.05            | (306)  |
| <b>Space heating</b>                                                                                                                    |                                              | <b>kWh/year</b> |        |
| Annual space heating requirement                                                                                                        |                                              | 61372.87        |        |
| Space heat from Community heat pump                                                                                                     | (98) x (304a) x (305) x (306) =              | 60897.23        | (307a) |
| Space heat from heat source 2                                                                                                           | (98) x (304b) x (305) x (306) =              | 6766.36         | (307b) |
| 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)  |
| <b>Water heating</b>                                                                                                                    |                                              |                 |        |
| Annual water heating requirement                                                                                                        |                                              | 3982.97         |        |
| If DHW from community scheme:                                                                                                           |                                              |                 |        |
| Water heat from Community heat pump                                                                                                     | (64) x (303a) x (305) x (306) =              | 3952.1          | (310a) |
| Water heat from heat source 2                                                                                                           | (64) x (303b) x (305) x (306) =              | 439.12          | (310b) |
| Electricity used for heat distribution                                                                                                  | 0.01 x [(307a)...(307e) + (310a)...(310e)] = | 720.55          | (313)  |
| Cooling System Energy Efficiency Ratio                                                                                                  |                                              | 4.32            | (314)  |
| Space cooling (if there is a fixed cooling system, if not enter 0)                                                                      | = (107) ÷ (314) =                            | 256.94          | (315)  |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside |                                              | 5800.05         | (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) =                  | 5800.05         | (331)  |
| Energy for lighting (calculated in Appendix L)                                                                                          |                                              | 2212.38         | (332)  |
| Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =                                    |                                              | 80324.17        | (338)  |

### 12b. CO2 Emissions – Community heating scheme

|                                                                         | Energy<br>kWh/year                                                        | Emission factor<br>kg CO2/kWh | Emissions<br>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 | 500                           | (367a)                   |
| 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 1                                       | [(307b)+(310b)] x 100 ÷ (367b) x                                          | 0.52                          | = 6731.36 (367)          |
| CO2 associated with heat source 2                                       | [(307b)+(310b)] x 100 ÷ (367b) x                                          | 0.22                          | = 1621.23 (368)          |
| Electrical energy for heat distribution                                 | [(313) x                                                                  | 0.52                          | = 373.96 (372)           |
| Total CO2 associated with community systems                             | (363)...(366) + (368)...(372)                                             |                               | = 8726.56 (373)          |
| CO2 associated with space heating (secondary)                           | (309) x                                                                   | 0                             | = 0 (374)                |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x                                                                   | 0.52                          | = 0 (375)                |

## DER WorkSheet: New dwelling design stage

|                                                                    |                         |      |   |          |       |
|--------------------------------------------------------------------|-------------------------|------|---|----------|-------|
| Total CO2 associated with space and water heating                  | (373) + (374) + (375) = |      |   | 8726.56  | (376) |
| CO2 associated with space cooling                                  | (315) x                 | 0.52 | = | 133.35   | (377) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x                | 0.52 | = | 3010.23  | (378) |
| CO2 associated with electricity for lighting                       | (332))) x               | 0.52 | = | 1148.22  | (379) |
| <b>Total CO2, kg/year</b>                                          | sum of (376)...(382) =  |      |   | 13018.36 | (383) |
| <b>Dwelling CO2 Emission Rate</b>                                  | (383) ÷ (4) =           |      |   | 7.49     | (384) |
| <b>EI rating (section 14)</b>                                      |                         |      |   | 90.21    | (385) |