

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.58  
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## Project Information:

**Assessed By:** John Young (STRO034821)

**Building Type:** Detached House

## Dwelling Details:

### NEW DWELLING DESIGN STAGE

Total Floor Area: 136.1m<sup>2</sup>

**Site Reference :** 104 Bekerley Avenue

**Plot Reference:** 104 Bekerley Avenue

**Address :** 104 Bekerley Avenue, Reading

## Client Details:

**Name:**

**Address :**

**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

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.54 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 4.91 kg/m<sup>2</sup> **OK**

## 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.2 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 51.2 kWh/m<sup>2</sup> **OK**

## 2 Fabric U-values

| Element       | Average          | Highest          |           |
|---------------|------------------|------------------|-----------|
| External wall | 0.19 (max. 0.30) | 0.19 (max. 0.70) | <b>OK</b> |
| Floor         | 0.11 (max. 0.25) | 0.11 (max. 0.70) | <b>OK</b> |
| Roof          | 0.11 (max. 0.20) | 0.11 (max. 0.35) | <b>OK</b> |
| Openings      | 1.40 (max. 2.00) | 1.40 (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 5.00 (design value)  
Maximum 10.0 **OK**

## 4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas  
Data from manufacturer  
Efficiency 89.6 % SEDBUK2009  
Minimum 88.0 % **OK**

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.29 kWh/day  
Permitted by DBSCG: 2.56 kWh/day **OK**

Primary pipework insulated: Yes **OK**

# Regulations Compliance Report

## 6 Controls

|                        |                                          |    |
|------------------------|------------------------------------------|----|
| Space heating controls | TTZC by plumbing and electrical services | OK |
| Hot water controls:    | Cylinderstat                             | OK |
|                        | Independent timer for DHW                | OK |
| Boiler interlock:      | Yes                                      | OK |

## 7 Low energy lights

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

## 8 Mechanical ventilation

Not applicable

## 9 Summertime temperature

|                                        |                    |    |
|----------------------------------------|--------------------|----|
| Overheating risk (North East England): | Not significant    | OK |
| Based on:                              |                    |    |
| Overshading:                           | Very Little        |    |
| Windows facing: North                  | 0.63m <sup>2</sup> |    |
| Windows facing: North                  | 0.63m <sup>2</sup> |    |
| Windows facing: North                  | 0.94m <sup>2</sup> |    |
| Windows facing: North                  | 2.5m <sup>2</sup>  |    |
| Windows facing: North                  | 2.5m <sup>2</sup>  |    |
| Windows facing: South                  | 2.25m <sup>2</sup> |    |
| Windows facing: South                  | 2.25m <sup>2</sup> |    |
| Windows facing: South                  | 2.1m <sup>2</sup>  |    |
| Windows facing: South                  | 9.94m <sup>2</sup> |    |
| Windows facing: East                   | 2m <sup>2</sup>    |    |
| Windows facing: East                   | 2m <sup>2</sup>    |    |
| Windows facing: East                   | 0.94m <sup>2</sup> |    |
| Windows facing: West                   | 0.94m <sup>2</sup> |    |
| Ventilation rate:                      | 8.00               |    |

## 10 Key features

|                    |                          |
|--------------------|--------------------------|
| Thermal bridging   | 0.025 W/m <sup>2</sup> K |
| Roofs U-value      | 0.11 W/m <sup>2</sup> K  |
| Floors U-value     | 0.11 W/m <sup>2</sup> K  |
| Photovoltaic array |                          |

## DFEE WorkSheet: New dwelling design stage

### User Details:

**Assessor Name:** John Young      **Stroma Number:** STRO034821  
**Software Name:** Stroma FSAP 2012      **Software Version:** Version: 1.0.5.58

Property Address: 104 Bekerley Avenue

**Address :** 104 Bekerley Avenue, Reading

### 1. Overall dwelling dimensions:

|                                                           | Area(m <sup>2</sup> )                   |   | Av. Height(m)                         |                                      | Volume(m <sup>3</sup> )                  |
|-----------------------------------------------------------|-----------------------------------------|---|---------------------------------------|--------------------------------------|------------------------------------------|
| Ground floor                                              | <input type="text" value="56.12"/> (1a) | x | <input type="text" value="2.4"/> (2a) | =                                    | <input type="text" value="134.7"/> (3a)  |
| First floor                                               | <input type="text" value="54.04"/> (1b) | x | <input type="text" value="2.6"/> (2b) | =                                    | <input type="text" value="140.49"/> (3b) |
| Second floor                                              | <input type="text" value="25.94"/> (1c) | x | <input type="text" value="2"/> (2c)   | =                                    | <input type="text" value="51.88"/> (3c)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | <input type="text" value="136.1"/> (4)  |   |                                       |                                      |                                          |
| Dwelling volume                                           |                                         |   |                                       | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | <input type="text" value="327.07"/> (5)  |

### 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"/> | = | <input type="text" value="0"/> | x 40 = | <input type="text" value="0"/> (6a)  |
| Number of open flues         | <input type="text" value="0"/> |   | <input type="text" value="0"/> |   | <input type="text" value="0"/> | = | <input type="text" value="0"/> | x 20 = | <input type="text" value="0"/> (6b)  |
| Number of intermittent fans  |                                |   |                                |   |                                |   | <input type="text" value="4"/> | x 10 = | <input type="text" value="40"/> (7a) |
| Number of passive vents      |                                |   |                                |   |                                |   | <input type="text" value="0"/> | x 10 = | <input type="text" value="0"/> (7b)  |
| Number of flueless gas fires |                                |   |                                |   |                                |   | <input type="text" value="0"/> | x 40 = | <input type="text" value="0"/> (7c)  |

### Air changes per hour

|                                                                                                                                                 |  |                                          |               |      |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------|---------------|------|------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =                                                                       |  | 40                                       | ÷ (5) =       | 0.12 | (8)  |
| If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)                              |  |                                          |               |      |      |
| Number of storeys in the dwelling (ns)                                                                                                          |  |                                          |               | 0    | (9)  |
| Additional infiltration                                                                                                                         |  |                                          | [(9)-1]x0.1 = | 0    | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction                                                        |  |                                          |               | 0    | (11) |
| if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 |  |                                          |               |      |      |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0                                                                   |  |                                          |               | 0    | (12) |
| If no draught lobby, enter 0.05, else enter 0                                                                                                   |  |                                          |               | 0    | (13) |
| Percentage of windows and doors draught stripped                                                                                                |  |                                          |               | 0    | (14) |
| Window infiltration                                                                                                                             |  | 0.25 - [0.2 x (14) ÷ 100] =              |               | 0    | (15) |
| Infiltration rate                                                                                                                               |  | (8) + (10) + (11) + (12) + (13) + (15) = |               | 0    | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area                                               |  |                                          |               | 5    | (17) |
| If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)                                                          |  |                                          |               | 0.37 | (18) |
| Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used                                |  |                                          |               |      |      |
| Number of sides sheltered                                                                                                                       |  |                                          |               | 2    | (19) |
| Shelter factor                                                                                                                                  |  | (20) = 1 - [0.075 x (19)] =              |               | 0.85 | (20) |
| Infiltration rate incorporating shelter factor                                                                                                  |  | (21) = (18) x (20) =                     |               | 0.32 | (21) |
| Infiltration rate modified for monthly wind speed                                                                                               |  |                                          |               |      |      |

# DFEE WorkSheet: New dwelling design stage

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

|  |     |     |      |      |      |     |     |      |      |      |      |      |
|--|-----|-----|------|------|------|-----|-----|------|------|------|------|------|
|  | 0.4 | 0.4 | 0.39 | 0.35 | 0.34 | 0.3 | 0.3 | 0.29 | 0.32 | 0.34 | 0.36 | 0.37 |
|--|-----|-----|------|------|------|-----|-----|------|------|------|------|------|

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 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 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 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= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (25)

## 3. Heat losses and heat loss parameter:

| ELEMENT         | Gross area (m²) | Openings m² | Net Area A ,m² | U-value W/m²K         | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K |
|-----------------|-----------------|-------------|----------------|-----------------------|-------------|-----------------|------------|
| Windows Type 1  |                 |             | 0.63           | $x1/[1/(1.4)+0.04] =$ | 0.84        |                 | (27)       |
| Windows Type 2  |                 |             | 0.63           | $x1/[1/(1.4)+0.04] =$ | 0.84        |                 | (27)       |
| Windows Type 3  |                 |             | 0.94           | $x1/[1/(1.4)+0.04] =$ | 1.25        |                 | (27)       |
| Windows Type 4  |                 |             | 2.5            | $x1/[1/(1.4)+0.04] =$ | 3.31        |                 | (27)       |
| Windows Type 5  |                 |             | 2.5            | $x1/[1/(1.4)+0.04] =$ | 3.31        |                 | (27)       |
| Windows Type 6  |                 |             | 2.25           | $x1/[1/(1.4)+0.04] =$ | 2.98        |                 | (27)       |
| Windows Type 7  |                 |             | 2.25           | $x1/[1/(1.4)+0.04] =$ | 2.98        |                 | (27)       |
| Windows Type 8  |                 |             | 2.1            | $x1/[1/(1.4)+0.04] =$ | 2.78        |                 | (27)       |
| Windows Type 9  |                 |             | 9.94           | $x1/[1/(1.4)+0.04] =$ | 13.18       |                 | (27)       |
| Windows Type 10 |                 |             | 2              | $x1/[1/(1.4)+0.04] =$ | 2.65        |                 | (27)       |
| Windows Type 11 |                 |             | 2              | $x1/[1/(1.4)+0.04] =$ | 2.65        |                 | (27)       |
| Windows Type 12 |                 |             | 0.94           | $x1/[1/(1.4)+0.04] =$ | 1.25        |                 | (27)       |
| Windows Type 13 |                 |             | 0.94           | $x1/[1/(1.4)+0.04] =$ | 1.25        |                 | (27)       |
| Floor           |                 |             | 56.125         | x 0.11 =              | 6.17375     |                 | (28)       |
| Walls Type1     | 40.22           | 7.2         | 33.02          | x 0.19 =              | 6.27        |                 | (29)       |
| Walls Type2     | 40.22           | 16.54       | 23.68          | x 0.19 =              | 4.5         |                 | (29)       |
| Walls Type3     | 101.78          | 4.94        | 96.84          | x 0.19 =              | 18.4        |                 | (29)       |

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|                                        |        |      |        |   |      |   |       |  |  |      |
|----------------------------------------|--------|------|--------|---|------|---|-------|--|--|------|
| Walls Type4                            | 101.78 | 0.94 | 100.84 | x | 0.19 | = | 19.16 |  |  | (29) |
| Walls Type5                            | 5.84   | 0    | 5.84   | x | 0.19 | = | 1.11  |  |  | (29) |
| Walls Type6                            | 0.25   | 0    | 0.25   | x | 0.19 | = | 0.05  |  |  | (29) |
| Walls Type7                            | 0.25   | 0    | 0.25   | x | 0.19 | = | 0.05  |  |  | (29) |
| Roof                                   | 85     | 0    | 85     | x | 0.11 | = | 9.35  |  |  | (30) |
| Total area of elements, m <sup>2</sup> |        |      | 431.47 |   |      |   |       |  |  | (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) = 104.33 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 51425.06 (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 10.8 (36)

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

Total fabric heat loss (33) + (36) = 115.13 (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= | 62.75 | 62.41 | 62.08 | 60.51 | 60.21 | 58.84 | 58.84 | 58.59 | 59.37 | 60.21 | 60.81 | 61.43 | (38) |

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

|        |                                          |        |       |        |        |        |        |        |       |        |        |        |      |
|--------|------------------------------------------|--------|-------|--------|--------|--------|--------|--------|-------|--------|--------|--------|------|
| (39)m= | 177.88                                   | 177.54 | 177.2 | 175.63 | 175.34 | 173.97 | 173.97 | 173.72 | 174.5 | 175.34 | 175.93 | 176.55 |      |
|        | Average = Sum(39) <sub>1...12</sub> /12= |        |       |        |        |        |        |        |       |        |        | 175.63 | (39) |

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

|                                          |      |     |     |      |      |      |      |      |      |      |      |     |      |      |
|------------------------------------------|------|-----|-----|------|------|------|------|------|------|------|------|-----|------|------|
| (40)m=                                   | 1.31 | 1.3 | 1.3 | 1.29 | 1.29 | 1.28 | 1.28 | 1.28 | 1.28 | 1.29 | 1.29 | 1.3 |      |      |
| Average = Sum(40) <sub>1...12</sub> /12= |      |     |     |      |      |      |      |      |      |      |      |     | 1.29 | (40) |

Number of days in month (Table 1a)

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

### 4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.91 (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)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 103.3 (43)

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

|                                                                                     | Jan                                 | Feb    | Mar    | Apr    | May  | Jun   | Jul   | Aug  | Sep    | Oct    | Nov    | Dec     |      |
|-------------------------------------------------------------------------------------|-------------------------------------|--------|--------|--------|------|-------|-------|------|--------|--------|--------|---------|------|
| Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) |                                     |        |        |        |      |       |       |      |        |        |        |         |      |
| (44)m=                                                                              | 113.62                              | 109.49 | 105.36 | 101.23 | 97.1 | 92.97 | 92.97 | 97.1 | 101.23 | 105.36 | 109.49 | 113.62  |      |
|                                                                                     | Total = Sum(44) <sub>1...12</sub> = |        |        |        |      |       |       |      |        |        |        | 1239.54 | (44) |

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

|        |                                     |        |        |        |        |        |        |        |        |        |        |         |      |
|--------|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------|
| (45)m= | 168.5                               | 147.37 | 152.08 | 132.58 | 127.22 | 109.78 | 101.73 | 116.73 | 118.13 | 137.66 | 150.27 | 163.19  |      |
|        | Total = Sum(45) <sub>1...12</sub> = |        |        |        |        |        |        |        |        |        |        | 1625.23 | (45) |

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

|        |   |   |   |   |   |   |   |   |   |   |   |   |      |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|------|
| (46)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (46) |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|------|

# DFEE WorkSheet: New dwelling design stage

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

250

(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):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

0 0 0 0 0 0 0 0 0 0 0 0

(56)

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=

0 0 0 0 0 0 0 0 0 0 0 0

(57)

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=

0 0 0 0 0 0 0 0 0 0 0 0

(59)

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

(61)

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

(62)m=

143.23 125.27 129.26 112.7 108.13 93.31 86.47 99.22 100.41 117.01 127.73 138.71

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRS applies, see Appendix G)

(63)m=

0 0 0 0 0 0 0 0 0 0 0 0

(63)

Output from water heater

(64)m=

143.23 125.27 129.26 112.7 108.13 93.31 86.47 99.22 100.41 117.01 127.73 138.71

Output from water heater (annual)<sub>1...12</sub>

1381.45

(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=

35.81 31.32 32.32 28.17 27.03 23.33 21.62 24.81 25.1 29.25 31.93 34.68

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

| Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 |

(66)

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

(67)m=

27.21 24.16 19.65 14.88 11.12 9.39 10.14 13.19 17.7 22.47 26.23 27.96

(67)

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

(68)m=

304.93 308.1 300.12 283.15 261.72 241.58 228.13 224.96 232.94 249.91 271.34 291.48

(68)

# DFEE WorkSheet: New dwelling design stage

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

(69)m= 

|       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

 (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= 

|         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

 (71)

Water heating gains (Table 5)

(72)m= 

|       |      |       |       |       |      |       |       |       |       |       |       |
|-------|------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|
| 48.13 | 46.6 | 43.44 | 39.13 | 36.34 | 32.4 | 29.05 | 33.34 | 34.86 | 39.32 | 44.35 | 46.61 |
|-------|------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|

 (72)

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

(73)m= 

|       |       |        |       |        |        |        |        |        |        |        |        |
|-------|-------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| 446.9 | 445.5 | 429.85 | 403.8 | 375.82 | 350.01 | 333.96 | 338.13 | 352.14 | 378.34 | 408.56 | 432.69 |
|-------|-------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|

 (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>m² |                                       | 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>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>2.05</td></tr></table>  | 2.05  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.05         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>2.05</td></tr></table>  | 2.05  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.05         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>3.05</td></tr></table>  | 3.05  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 3.05         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>8.12</td></tr></table>  | 8.12  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 8.12         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>8.12</td></tr></table>  | 8.12  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 8.12         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>3.91</td></tr></table>  | 3.91  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 3.91         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>3.91</td></tr></table>  | 3.91  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 3.91         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>5.84</td></tr></table>  | 5.84  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 5.84         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.53</td></tr></table> | 15.53 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.53        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.53</td></tr></table> | 15.53 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.53        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>6.65</td></tr></table>  | 6.65  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 6.65         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>6.65</td></tr></table>  | 6.65  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 6.65         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>9.92</td></tr></table>  | 9.92  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 9.92         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>26.38</td></tr></table> | 26.38 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 26.38        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>26.38</td></tr></table> | 26.38 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 26.38        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>10.68</td></tr></table> | 10.68 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.68        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>10.68</td></tr></table> | 10.68 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.68        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.93</td></tr></table> | 15.93 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.93        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>42.38</td></tr></table> | 42.38 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 42.38        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>42.38</td></tr></table> | 42.38 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 42.38        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>14.39</td></tr></table> | 14.39 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 14.39        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>14.39</td></tr></table> | 14.39 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 14.39        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>21.46</td></tr></table> | 21.46 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 21.46        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>57.09</td></tr></table> | 57.09 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 57.09        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>57.09</td></tr></table> | 57.09 | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 57.09        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x          | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.4</td></tr></table>  | 15.4  | (74) |
| 0.77         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 79.99        |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.4         |                           |                                       |      |            |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |

## DFEE WorkSheet: New dwelling design stage

|       |      |      |   |      |   |       |   |      |   |     |   |       |      |
|-------|------|------|---|------|---|-------|---|------|---|-----|---|-------|------|
| North | 0.9x | 0.77 | x | 0.63 | x | 79.99 | x | 0.63 | x | 0.7 | = | 15.4  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 79.99 | x | 0.63 | x | 0.7 | = | 22.98 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 79.99 | x | 0.63 | x | 0.7 | = | 61.11 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 79.99 | x | 0.63 | x | 0.7 | = | 61.11 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 74.68 | x | 0.63 | x | 0.7 | = | 14.38 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 74.68 | x | 0.63 | x | 0.7 | = | 14.38 | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 74.68 | x | 0.63 | x | 0.7 | = | 21.45 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 74.68 | x | 0.63 | x | 0.7 | = | 57.06 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 74.68 | x | 0.63 | x | 0.7 | = | 57.06 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 59.25 | x | 0.63 | x | 0.7 | = | 11.41 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 59.25 | x | 0.63 | x | 0.7 | = | 11.41 | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 59.25 | x | 0.63 | x | 0.7 | = | 17.02 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 59.25 | x | 0.63 | x | 0.7 | = | 45.27 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 59.25 | x | 0.63 | x | 0.7 | = | 45.27 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 41.52 | x | 0.63 | x | 0.7 | = | 7.99  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 41.52 | x | 0.63 | x | 0.7 | = | 7.99  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 41.52 | x | 0.63 | x | 0.7 | = | 11.93 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 41.52 | x | 0.63 | x | 0.7 | = | 31.72 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 41.52 | x | 0.63 | x | 0.7 | = | 31.72 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 24.19 | x | 0.63 | x | 0.7 | = | 4.66  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 24.19 | x | 0.63 | x | 0.7 | = | 4.66  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 24.19 | x | 0.63 | x | 0.7 | = | 6.95  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 24.19 | x | 0.63 | x | 0.7 | = | 18.48 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 24.19 | x | 0.63 | x | 0.7 | = | 18.48 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 13.12 | x | 0.63 | x | 0.7 | = | 2.53  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 13.12 | x | 0.63 | x | 0.7 | = | 2.53  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 13.12 | x | 0.63 | x | 0.7 | = | 3.77  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 13.12 | x | 0.63 | x | 0.7 | = | 10.02 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 13.12 | x | 0.63 | x | 0.7 | = | 10.02 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 8.86  | x | 0.63 | x | 0.7 | = | 1.71  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 8.86  | x | 0.63 | x | 0.7 | = | 1.71  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 8.86  | x | 0.63 | x | 0.7 | = | 2.55  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 8.86  | x | 0.63 | x | 0.7 | = | 6.77  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 8.86  | x | 0.63 | x | 0.7 | = | 6.77  | (74) |
| East  | 0.9x | 0.77 | x | 2    | x | 19.64 | x | 0.63 | x | 0.7 | = | 12    | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 19.64 | x | 0.63 | x | 0.7 | = | 12    | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 19.64 | x | 0.63 | x | 0.7 | = | 5.64  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 38.42 | x | 0.63 | x | 0.7 | = | 23.48 | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 38.42 | x | 0.63 | x | 0.7 | = | 23.48 | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 38.42 | x | 0.63 | x | 0.7 | = | 11.04 | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 63.27 | x | 0.63 | x | 0.7 | = | 38.67 | (76) |

## DFEE WorkSheet: New dwelling design stage

|       |      |      |   |      |   |        |   |      |   |     |   |        |      |
|-------|------|------|---|------|---|--------|---|------|---|-----|---|--------|------|
| East  | 0.9x | 0.77 | x | 2    | x | 63.27  | x | 0.63 | x | 0.7 | = | 38.67  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 63.27  | x | 0.63 | x | 0.7 | = | 18.18  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 92.28  | x | 0.63 | x | 0.7 | = | 56.4   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 92.28  | x | 0.63 | x | 0.7 | = | 56.4   | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 92.28  | x | 0.63 | x | 0.7 | = | 26.51  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 113.09 | x | 0.63 | x | 0.7 | = | 69.13  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 113.09 | x | 0.63 | x | 0.7 | = | 69.13  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 113.09 | x | 0.63 | x | 0.7 | = | 32.49  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 115.77 | x | 0.63 | x | 0.7 | = | 70.76  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 115.77 | x | 0.63 | x | 0.7 | = | 70.76  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 115.77 | x | 0.63 | x | 0.7 | = | 33.26  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 110.22 | x | 0.63 | x | 0.7 | = | 67.37  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 110.22 | x | 0.63 | x | 0.7 | = | 67.37  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 110.22 | x | 0.63 | x | 0.7 | = | 31.66  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 94.68  | x | 0.63 | x | 0.7 | = | 57.87  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 94.68  | x | 0.63 | x | 0.7 | = | 57.87  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 94.68  | x | 0.63 | x | 0.7 | = | 27.2   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 73.59  | x | 0.63 | x | 0.7 | = | 44.98  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 73.59  | x | 0.63 | x | 0.7 | = | 44.98  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 73.59  | x | 0.63 | x | 0.7 | = | 21.14  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 45.59  | x | 0.63 | x | 0.7 | = | 27.87  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 45.59  | x | 0.63 | x | 0.7 | = | 27.87  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 45.59  | x | 0.63 | x | 0.7 | = | 13.1   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 24.49  | x | 0.63 | x | 0.7 | = | 14.97  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 24.49  | x | 0.63 | x | 0.7 | = | 14.97  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 24.49  | x | 0.63 | x | 0.7 | = | 7.04   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 16.15  | x | 0.63 | x | 0.7 | = | 9.87   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 16.15  | x | 0.63 | x | 0.7 | = | 9.87   | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 16.15  | x | 0.63 | x | 0.7 | = | 4.64   | (76) |
| South | 0.9x | 0.77 | x | 2.25 | x | 46.75  | x | 0.63 | x | 0.7 | = | 32.15  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 46.75  | x | 0.63 | x | 0.7 | = | 32.15  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 46.75  | x | 0.63 | x | 0.7 | = | 30     | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 46.75  | x | 0.63 | x | 0.7 | = | 142.02 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 76.57  | x | 0.63 | x | 0.7 | = | 52.65  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 76.57  | x | 0.63 | x | 0.7 | = | 52.65  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 76.57  | x | 0.63 | x | 0.7 | = | 49.14  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 76.57  | x | 0.63 | x | 0.7 | = | 232.6  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 97.53  | x | 0.63 | x | 0.7 | = | 67.07  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 97.53  | x | 0.63 | x | 0.7 | = | 67.07  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 97.53  | x | 0.63 | x | 0.7 | = | 62.6   | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 97.53  | x | 0.63 | x | 0.7 | = | 296.29 | (78) |

## DFEE WorkSheet: New dwelling design stage

|       |      |      |   |      |   |        |   |      |   |     |   |        |      |
|-------|------|------|---|------|---|--------|---|------|---|-----|---|--------|------|
| South | 0.9x | 0.77 | x | 2.25 | x | 110.23 | x | 0.63 | x | 0.7 | = | 75.8   | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 110.23 | x | 0.63 | x | 0.7 | = | 75.8   | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 110.23 | x | 0.63 | x | 0.7 | = | 70.75  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 110.23 | x | 0.63 | x | 0.7 | = | 334.87 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 114.87 | x | 0.63 | x | 0.7 | = | 78.99  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 114.87 | x | 0.63 | x | 0.7 | = | 78.99  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 114.87 | x | 0.63 | x | 0.7 | = | 73.72  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 114.87 | x | 0.63 | x | 0.7 | = | 348.95 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 110.55 | x | 0.63 | x | 0.7 | = | 76.02  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 110.55 | x | 0.63 | x | 0.7 | = | 76.02  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 110.55 | x | 0.63 | x | 0.7 | = | 70.95  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 110.55 | x | 0.63 | x | 0.7 | = | 335.82 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 108.01 | x | 0.63 | x | 0.7 | = | 74.27  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 108.01 | x | 0.63 | x | 0.7 | = | 74.27  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 108.01 | x | 0.63 | x | 0.7 | = | 69.32  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 108.01 | x | 0.63 | x | 0.7 | = | 328.12 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 104.89 | x | 0.63 | x | 0.7 | = | 72.13  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 104.89 | x | 0.63 | x | 0.7 | = | 72.13  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 104.89 | x | 0.63 | x | 0.7 | = | 67.32  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 104.89 | x | 0.63 | x | 0.7 | = | 318.65 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 101.89 | x | 0.63 | x | 0.7 | = | 70.06  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 101.89 | x | 0.63 | x | 0.7 | = | 70.06  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 101.89 | x | 0.63 | x | 0.7 | = | 65.39  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 101.89 | x | 0.63 | x | 0.7 | = | 309.51 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 82.59  | x | 0.63 | x | 0.7 | = | 56.79  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 82.59  | x | 0.63 | x | 0.7 | = | 56.79  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 82.59  | x | 0.63 | x | 0.7 | = | 53     | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 82.59  | x | 0.63 | x | 0.7 | = | 250.88 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 55.42  | x | 0.63 | x | 0.7 | = | 38.11  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 55.42  | x | 0.63 | x | 0.7 | = | 38.11  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 55.42  | x | 0.63 | x | 0.7 | = | 35.57  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 55.42  | x | 0.63 | x | 0.7 | = | 168.35 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 40.4   | x | 0.63 | x | 0.7 | = | 27.78  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 40.4   | x | 0.63 | x | 0.7 | = | 27.78  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 40.4   | x | 0.63 | x | 0.7 | = | 25.93  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 40.4   | x | 0.63 | x | 0.7 | = | 122.72 | (78) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 19.64  | x | 0.63 | x | 0.7 | = | 5.64   | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 38.42  | x | 0.63 | x | 0.7 | = | 11.04  | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 63.27  | x | 0.63 | x | 0.7 | = | 18.18  | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 92.28  | x | 0.63 | x | 0.7 | = | 26.51  | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 113.09 | x | 0.63 | x | 0.7 | = | 32.49  | (80) |

## DFEE WorkSheet: New dwelling design stage

|      |      |      |   |      |   |        |   |      |   |     |   |       |      |
|------|------|------|---|------|---|--------|---|------|---|-----|---|-------|------|
| West | 0.9x | 0.77 | x | 0.94 | x | 115.77 | x | 0.63 | x | 0.7 | = | 33.26 | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 110.22 | x | 0.63 | x | 0.7 | = | 31.66 | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 94.68  | x | 0.63 | x | 0.7 | = | 27.2  | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 73.59  | x | 0.63 | x | 0.7 | = | 21.14 | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 45.59  | x | 0.63 | x | 0.7 | = | 13.1  | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 24.49  | x | 0.63 | x | 0.7 | = | 7.04  | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 16.15  | x | 0.63 | x | 0.7 | = | 4.64  | (80) |

Solar gains in watts, calculated for each month

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

|        |        |        |       |        |        |        |        |        |        |        |     |        |      |
|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|-----|--------|------|
| (83)m= | 295.02 | 500.79 | 682.7 | 845.09 | 948.29 | 942.84 | 908.36 | 830.72 | 738.61 | 552.61 | 353 | 252.74 | (83) |
|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|-----|--------|------|

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

|        |        |       |         |         |        |         |         |         |         |        |        |        |      |
|--------|--------|-------|---------|---------|--------|---------|---------|---------|---------|--------|--------|--------|------|
| (84)m= | 741.92 | 946.3 | 1112.55 | 1248.88 | 1324.1 | 1292.85 | 1242.33 | 1168.85 | 1090.75 | 930.95 | 761.55 | 685.42 | (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   | 0.99 | 0.96 | 0.9 | 0.76 | 0.59 | 0.64 | 0.86 | 0.98 | 1   | 1   | (86) |

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

|        |      |       |       |       |      |       |       |       |       |       |       |       |      |
|--------|------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|
| (87)m= | 19.5 | 19.71 | 20.01 | 20.38 | 20.7 | 20.91 | 20.98 | 20.97 | 20.82 | 20.38 | 19.87 | 19.47 | (87) |
|--------|------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (88)m= | 19.84 | 19.84 | 19.84 | 19.85 | 19.85 | 19.86 | 19.86 | 19.86 | 19.85 | 19.85 | 19.85 | 19.84 | (88) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

|        |   |      |      |      |      |      |      |     |      |      |   |   |      |
|--------|---|------|------|------|------|------|------|-----|------|------|---|---|------|
| (89)m= | 1 | 0.99 | 0.98 | 0.95 | 0.85 | 0.66 | 0.45 | 0.5 | 0.79 | 0.97 | 1 | 1 | (89) |
|--------|---|------|------|------|------|------|------|-----|------|------|---|---|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (90)m= | 18.48 | 18.69 | 18.99 | 19.35 | 19.65 | 19.82 | 19.85 | 19.85 | 19.76 | 19.36 | 18.85 | 18.45 | (90) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

fLA = Living area ÷ (4) =

0.14 (91)

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

|        |       |       |       |       |       |       |       |    |      |      |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|----|------|------|-------|-------|------|
| (92)m= | 18.62 | 18.83 | 19.13 | 19.49 | 19.79 | 19.96 | 20.01 | 20 | 19.9 | 19.5 | 18.99 | 18.59 | (92) |
|--------|-------|-------|-------|-------|-------|-------|-------|----|------|------|-------|-------|------|

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

|        |       |       |       |       |       |       |       |    |      |      |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|----|------|------|-------|-------|------|
| (93)m= | 18.62 | 18.83 | 19.13 | 19.49 | 19.79 | 19.96 | 20.01 | 20 | 19.9 | 19.5 | 18.99 | 18.59 | (93) |
|--------|-------|-------|-------|-------|-------|-------|-------|----|------|------|-------|-------|------|

### 8. Space heating requirement

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

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

Utilisation factor for gains, hm:

|        |   |      |      |      |      |      |      |      |      |      |      |   |      |
|--------|---|------|------|------|------|------|------|------|------|------|------|---|------|
| (94)m= | 1 | 0.99 | 0.98 | 0.94 | 0.85 | 0.67 | 0.47 | 0.52 | 0.79 | 0.96 | 0.99 | 1 | (94) |
|--------|---|------|------|------|------|------|------|------|------|------|------|---|------|

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

|        |        |        |         |         |         |        |        |        |        |        |       |        |      |
|--------|--------|--------|---------|---------|---------|--------|--------|--------|--------|--------|-------|--------|------|
| (95)m= | 739.98 | 938.87 | 1088.87 | 1174.89 | 1123.21 | 864.67 | 582.14 | 609.08 | 861.43 | 893.91 | 756.8 | 684.16 | (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= | 2546.82 | 2472.77 | 2237.3 | 1859.94 | 1418.46 | 933.16 | 592.41 | 625.71 | 1012.22 | 1560.87 | 2091.22 | 2539.85 | (97) |
|--------|---------|---------|--------|---------|---------|--------|--------|--------|---------|---------|---------|---------|------|

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

|        |         |         |        |        |        |   |   |   |   |        |        |         |  |
|--------|---------|---------|--------|--------|--------|---|---|---|---|--------|--------|---------|--|
| (98)m= | 1344.29 | 1030.78 | 854.44 | 493.23 | 219.67 | 0 | 0 | 0 | 0 | 496.22 | 960.78 | 1380.63 |  |
|--------|---------|---------|--------|--------|--------|---|---|---|---|--------|--------|---------|--|

## DFEE WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> = 6780.03 (98)

Space heating requirement in kWh/m<sup>2</sup>/year 49.82 (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 | 1635.32 | 1287.38 | 1320.25 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---------|---------|---------|---|---|---|---|

 (100)

Utilisation factor for loss hm

(101)m= 

|   |   |   |   |   |      |      |      |   |   |   |   |
|---|---|---|---|---|------|------|------|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0.82 | 0.89 | 0.87 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|------|------|------|---|---|---|---|

 (101)

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

(102)m= 

|   |   |   |   |   |         |         |         |   |   |   |   |
|---|---|---|---|---|---------|---------|---------|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 1343.07 | 1149.69 | 1145.13 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---------|---------|---------|---|---|---|---|

 (102)

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

(103)m= 

|   |   |   |   |   |         |         |        |   |   |   |   |
|---|---|---|---|---|---------|---------|--------|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 1632.01 | 1570.18 | 1486.6 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---------|---------|--------|---|---|---|---|

 (103)

Space cooling requirement for month, whole dwelling, continuous ( kWh) = 0.024 x [(103)m – (102)m ] x (41)m

set (104)m to zero if (104)m < 3 × (98)m

(104)m= 

|   |   |   |   |   |        |        |        |   |   |   |   |
|---|---|---|---|---|--------|--------|--------|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 208.04 | 312.85 | 254.06 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|--------|--------|--------|---|---|---|---|

Total = Sum(104) = 774.94 (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 × (105) × (106)m

(107)m= 

|   |   |   |   |   |       |       |       |   |   |   |   |
|---|---|---|---|---|-------|-------|-------|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 52.01 | 78.21 | 63.51 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|-------|-------|-------|---|---|---|---|

Total = Sum(107) = 193.73 (107)

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

(107) ÷ (4) = 1.42 (108)

### 8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 51.24 (109)

# DER WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** John Young **Stroma Number:** STRO034821  
**Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.5.58

Property Address: 104 Bekerley Avenue

**Address :** 104 Bekerley Avenue, Reading

## 1. Overall dwelling dimensions:

|                                                           | Area(m <sup>2</sup> ) |   | Av. Height(m) |                                      | Volume(m <sup>3</sup> ) |
|-----------------------------------------------------------|-----------------------|---|---------------|--------------------------------------|-------------------------|
| Ground floor                                              | 56.12 (1a)            | x | 2.4 (2a)      | =                                    | 134.7 (3a)              |
| First floor                                               | 54.04 (1b)            | x | 2.6 (2b)      | =                                    | 140.49 (3b)             |
| Second floor                                              | 25.94 (1c)            | x | 2 (2c)        | =                                    | 51.88 (3c)              |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 136.1 (4)             |   |               |                                      |                         |
| Dwelling volume                                           |                       |   |               | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 327.07 (5)              |

## 2. Ventilation rate:

|                              | main heating | secondary heating | other | total    | m <sup>3</sup> per hour |
|------------------------------|--------------|-------------------|-------|----------|-------------------------|
| Number of chimneys           | 0            | +                 | 0     | =        | 0 (6a)                  |
| Number of open flues         | 0            | +                 | 0     | =        | 0 (6b)                  |
| Number of intermittent fans  |              |                   |       | 5 x 10 = | 50 (7a)                 |
| Number of passive vents      |              |                   |       | 0 x 10 = | 0 (7b)                  |
| Number of flueless gas fires |              |                   |       | 0 x 40 = | 0 (7c)                  |

## Air changes per hour

|                                                                                                                                                        |                                          |               |      |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------|------|------|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =                                                                              | 50                                       | ÷ (5) =       | 0.15 | (8)  |
| <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)                                                                                                                 |                                          |               | 0    | (9)  |
| Additional infiltration                                                                                                                                |                                          | [(9)-1]x0.1 = | 0    | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction                                                               |                                          |               | 0    | (11) |
| <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> |                                          |               |      |      |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0                                                                          |                                          |               | 0    | (12) |
| If no draught lobby, enter 0.05, else enter 0                                                                                                          |                                          |               | 0    | (13) |
| Percentage of windows and doors draught stripped                                                                                                       |                                          |               | 0    | (14) |
| Window infiltration                                                                                                                                    | 0.25 - [0.2 x (14) ÷ 100] =              |               | 0    | (15) |
| Infiltration rate                                                                                                                                      | (8) + (10) + (11) + (12) + (13) + (15) = |               | 0    | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area                                                      |                                          |               | 5    | (17) |
| If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)                                                                 |                                          |               | 0.4  | (18) |
| <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                                                                                                                              |                                          |               | 2    | (19) |
| Shelter factor                                                                                                                                         | (20) = 1 - [0.075 x (19)] =              |               | 0.85 | (20) |
| Infiltration rate incorporating shelter factor                                                                                                         | (21) = (18) x (20) =                     |               | 0.34 | (21) |
| Infiltration rate modified for monthly wind speed                                                                                                      |                                          |               |      |      |

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

## DER WorkSheet: New dwelling design stage

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

|  |      |      |      |      |      |      |      |      |      |      |      |     |
|--|------|------|------|------|------|------|------|------|------|------|------|-----|
|  | 0.44 | 0.43 | 0.42 | 0.38 | 0.37 | 0.33 | 0.33 | 0.32 | 0.34 | 0.37 | 0.39 | 0.4 |
|--|------|------|------|------|------|------|------|------|------|------|------|-----|

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 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 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 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= 0.6 0.59 0.59 0.57 0.57 0.55 0.55 0.55 0.56 0.57 0.57 0.58 (24d)

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

(25)m= 0.6 0.59 0.59 0.57 0.57 0.55 0.55 0.55 0.56 0.57 0.57 0.58 (25)

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

| ELEMENT         | Gross area (m²) | Openings m² | Net Area A ,m² | U-value W/m²K                 | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K |
|-----------------|-----------------|-------------|----------------|-------------------------------|-------------|-----------------|------------|
| Windows Type 1  |                 |             | 0.63           | $\times 1/[1/(1.4) + 0.04] =$ | 0.84        |                 | (27)       |
| Windows Type 2  |                 |             | 0.63           | $\times 1/[1/(1.4) + 0.04] =$ | 0.84        |                 | (27)       |
| Windows Type 3  |                 |             | 0.94           | $\times 1/[1/(1.4) + 0.04] =$ | 1.25        |                 | (27)       |
| Windows Type 4  |                 |             | 2.5            | $\times 1/[1/(1.4) + 0.04] =$ | 3.31        |                 | (27)       |
| Windows Type 5  |                 |             | 2.5            | $\times 1/[1/(1.4) + 0.04] =$ | 3.31        |                 | (27)       |
| Windows Type 6  |                 |             | 2.25           | $\times 1/[1/(1.4) + 0.04] =$ | 2.98        |                 | (27)       |
| Windows Type 7  |                 |             | 2.25           | $\times 1/[1/(1.4) + 0.04] =$ | 2.98        |                 | (27)       |
| Windows Type 8  |                 |             | 2.1            | $\times 1/[1/(1.4) + 0.04] =$ | 2.78        |                 | (27)       |
| Windows Type 9  |                 |             | 9.94           | $\times 1/[1/(1.4) + 0.04] =$ | 13.18       |                 | (27)       |
| Windows Type 10 |                 |             | 2              | $\times 1/[1/(1.4) + 0.04] =$ | 2.65        |                 | (27)       |
| Windows Type 11 |                 |             | 2              | $\times 1/[1/(1.4) + 0.04] =$ | 2.65        |                 | (27)       |
| Windows Type 12 |                 |             | 0.94           | $\times 1/[1/(1.4) + 0.04] =$ | 1.25        |                 | (27)       |
| Windows Type 13 |                 |             | 0.94           | $\times 1/[1/(1.4) + 0.04] =$ | 1.25        |                 | (27)       |
| Floor           |                 |             | 56.125         | $\times$ 0.11 =               | 6.17375     |                 | (28)       |
| Walls Type1     | 40.22           | 7.2         | 33.02          | $\times$ 0.19 =               | 6.27        |                 | (29)       |
| Walls Type2     | 40.22           | 16.54       | 23.68          | $\times$ 0.19 =               | 4.5         |                 | (29)       |
| Walls Type3     | 101.78          | 4.94        | 96.84          | $\times$ 0.19 =               | 18.4        |                 | (29)       |

## DER WorkSheet: New dwelling design stage

|                                        |        |      |        |   |      |   |       |  |  |      |
|----------------------------------------|--------|------|--------|---|------|---|-------|--|--|------|
| Walls Type4                            | 101.78 | 0.94 | 100.84 | x | 0.19 | = | 19.16 |  |  | (29) |
| Walls Type5                            | 5.84   | 0    | 5.84   | x | 0.19 | = | 1.11  |  |  | (29) |
| Walls Type6                            | 0.25   | 0    | 0.25   | x | 0.19 | = | 0.05  |  |  | (29) |
| Walls Type7                            | 0.25   | 0    | 0.25   | x | 0.19 | = | 0.05  |  |  | (29) |
| Roof                                   | 85     | 0    | 85     | x | 0.11 | = | 9.35  |  |  | (30) |
| Total area of elements, m <sup>2</sup> |        |      | 431.47 |   |      |   |       |  |  | (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) = 104.33 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 51425.06 (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 10.8 (36)

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

Total fabric heat loss (33) + (36) = 115.13 (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= | 64.25 | 63.86 | 63.46 | 61.62 | 61.28 | 59.68 | 59.68 | 59.38 | 60.3 | 61.28 | 61.98 | 62.7 | (38) |

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

|        |                                          |        |        |        |        |       |       |        |        |        |       |        |             |
|--------|------------------------------------------|--------|--------|--------|--------|-------|-------|--------|--------|--------|-------|--------|-------------|
| (39)m= | 179.38                                   | 178.98 | 178.59 | 176.75 | 176.41 | 174.8 | 174.8 | 174.51 | 175.42 | 176.41 | 177.1 | 177.83 |             |
|        | Average = Sum(39) <sub>1...12</sub> /12= |        |        |        |        |       |       |        |        |        |       |        | 176.75 (39) |

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

|        |                                          |      |      |     |     |      |      |      |      |     |     |      |          |
|--------|------------------------------------------|------|------|-----|-----|------|------|------|------|-----|-----|------|----------|
| (40)m= | 1.32                                     | 1.32 | 1.31 | 1.3 | 1.3 | 1.28 | 1.28 | 1.28 | 1.29 | 1.3 | 1.3 | 1.31 |          |
|        | Average = Sum(40) <sub>1...12</sub> /12= |      |      |     |     |      |      |      |      |     |     |      | 1.3 (40) |

Number of days in month (Table 1a)

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

### 4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.91 (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)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 103.3 (43)

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

|                                                                                     | Jan                                 | Feb    | Mar    | Apr    | May  | Jun   | Jul   | Aug  | Sep    | Oct    | Nov    | Dec    |              |
|-------------------------------------------------------------------------------------|-------------------------------------|--------|--------|--------|------|-------|-------|------|--------|--------|--------|--------|--------------|
| Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) |                                     |        |        |        |      |       |       |      |        |        |        |        |              |
| (44)m=                                                                              | 113.62                              | 109.49 | 105.36 | 101.23 | 97.1 | 92.97 | 92.97 | 97.1 | 101.23 | 105.36 | 109.49 | 113.62 |              |
|                                                                                     | Total = Sum(44) <sub>1...12</sub> = |        |        |        |      |       |       |      |        |        |        |        | 1239.54 (44) |

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

|        |                                     |        |        |        |        |        |        |        |        |        |        |        |              |
|--------|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| (45)m= | 168.5                               | 147.37 | 152.08 | 132.58 | 127.22 | 109.78 | 101.73 | 116.73 | 118.13 | 137.66 | 150.27 | 163.19 |              |
|        | Total = Sum(45) <sub>1...12</sub> = |        |        |        |        |        |        |        |        |        |        |        | 1625.23 (45) |

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (46)m= | 25.28 | 22.11 | 22.81 | 19.89 | 19.08 | 16.47 | 15.26 | 17.51 | 17.72 | 20.65 | 22.54 | 24.48 | (46) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

## DER WorkSheet: New dwelling design stage

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 250 (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): 1.29 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.7 (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) 0.7 (55)

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

(56)m= 

|       |      |       |      |       |      |       |       |      |       |      |       |
|-------|------|-------|------|-------|------|-------|-------|------|-------|------|-------|
| 21.59 | 19.5 | 21.59 | 20.9 | 21.59 | 20.9 | 21.59 | 21.59 | 20.9 | 21.59 | 20.9 | 21.59 |
|-------|------|-------|------|-------|------|-------|-------|------|-------|------|-------|

 (56)

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= 

|       |      |       |      |       |      |       |       |      |       |      |       |
|-------|------|-------|------|-------|------|-------|-------|------|-------|------|-------|
| 21.59 | 19.5 | 21.59 | 20.9 | 21.59 | 20.9 | 21.59 | 21.59 | 20.9 | 21.59 | 20.9 | 21.59 |
|-------|------|-------|------|-------|------|-------|-------|------|-------|------|-------|

 (57)

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

 (59)

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

 (61)

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

(62)m= 

|        |        |        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 213.36 | 187.89 | 196.93 | 175.99 | 172.07 | 153.19 | 146.58 | 161.59 | 161.54 | 182.52 | 193.68 | 208.04 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRS applies, see Appendix G)

(63)m= 

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|

 (63)

Output from water heater

(64)m= 

|        |        |        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 213.36 | 187.89 | 196.93 | 175.99 | 172.07 | 153.19 | 146.58 | 161.59 | 161.54 | 182.52 | 193.68 | 208.04 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

Output from water heater (annual)<sub>1...12</sub> 2153.39 (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= 

|       |       |       |       |       |       |       |      |    |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|------|----|-------|-------|-------|
| 91.91 | 81.41 | 86.45 | 78.81 | 78.19 | 71.23 | 69.71 | 74.7 | 74 | 81.66 | 84.69 | 90.14 |
|-------|-------|-------|-------|-------|-------|-------|------|----|-------|-------|-------|

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m= 

| Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 | 145.46 |

 (66)

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

(67)m= 

|       |       |       |       |       |      |       |       |      |       |       |       |
|-------|-------|-------|-------|-------|------|-------|-------|------|-------|-------|-------|
| 27.21 | 24.16 | 19.65 | 14.88 | 11.12 | 9.39 | 10.14 | 13.19 | 17.7 | 22.47 | 26.23 | 27.96 |
|-------|-------|-------|-------|-------|------|-------|-------|------|-------|-------|-------|

 (67)

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

(68)m= 

|        |       |        |        |        |        |        |        |        |        |        |        |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 304.93 | 308.1 | 300.12 | 283.15 | 261.72 | 241.58 | 228.13 | 224.96 | 232.94 | 249.91 | 271.34 | 291.48 |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (68)

# DER WorkSheet: New dwelling design stage

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

(69)m= 

|       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 | 37.55 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

 (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= 

|         |         |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 | -116.37 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

 (71)

Water heating gains (Table 5)

(72)m= 

|        |        |       |        |        |       |      |       |        |        |        |        |
|--------|--------|-------|--------|--------|-------|------|-------|--------|--------|--------|--------|
| 123.54 | 121.15 | 116.2 | 109.46 | 105.09 | 98.93 | 93.7 | 100.4 | 102.78 | 109.76 | 117.63 | 121.16 |
|--------|--------|-------|--------|--------|-------|------|-------|--------|--------|--------|--------|

 (72)

**Total internal gains =**

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m  
(73)m= 

|        |        |        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 525.32 | 523.05 | 505.61 | 477.13 | 447.57 | 419.54 | 401.61 | 408.19 | 423.06 | 451.78 | 484.84 | 510.24 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (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>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>2.05</td></tr></table>  | 2.05  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.05         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>2.05</td></tr></table>  | 2.05  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.05         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>3.05</td></tr></table>  | 3.05  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 3.05         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>8.12</td></tr></table>  | 8.12  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 8.12         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>8.12</td></tr></table>  | 8.12  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.63        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 8.12         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>3.91</td></tr></table>  | 3.91  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 3.91         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>3.91</td></tr></table>  | 3.91  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 3.91         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>5.84</td></tr></table>  | 5.84  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 5.84         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.53</td></tr></table> | 15.53 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.53        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.53</td></tr></table> | 15.53 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 20.32        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.53        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>6.65</td></tr></table>  | 6.65  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 6.65         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>6.65</td></tr></table>  | 6.65  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 6.65         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>9.92</td></tr></table>  | 9.92  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 9.92         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>26.38</td></tr></table> | 26.38 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 26.38        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>26.38</td></tr></table> | 26.38 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 34.53        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 26.38        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>10.68</td></tr></table> | 10.68 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.68        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>10.68</td></tr></table> | 10.68 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 10.68        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.93</td></tr></table> | 15.93 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.93        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>42.38</td></tr></table> | 42.38 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 42.38        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>42.38</td></tr></table> | 42.38 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 55.46        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 42.38        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>14.39</td></tr></table> | 14.39 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 14.39        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>14.39</td></tr></table> | 14.39 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 14.39        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.94</td></tr></table> | 0.94             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>21.46</td></tr></table> | 21.46 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.94         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 21.46        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>57.09</td></tr></table> | 57.09 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 57.09        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>2.5</td></tr></table>  | 2.5              | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>57.09</td></tr></table> | 57.09 | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 2.5          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 74.72        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 57.09        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| North        | 0.9x                      | <table><tr><td>0.77</td></tr></table> | 0.77 | x                      | <table><tr><td>0.63</td></tr></table> | 0.63             | 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>0.7</td></tr></table> | 0.7 | = | <table><tr><td>15.4</td></tr></table>  | 15.4  | (74) |
| 0.77         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 79.99        |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.63         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 0.7          |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |
| 15.4         |                           |                                       |      |                        |                                       |                  |   |                                        |       |                |                                       |              |   |                                      |     |   |                                        |       |      |

## DER WorkSheet: New dwelling design stage

|       |      |      |   |      |   |       |   |      |   |     |   |       |      |
|-------|------|------|---|------|---|-------|---|------|---|-----|---|-------|------|
| North | 0.9x | 0.77 | x | 0.63 | x | 79.99 | x | 0.63 | x | 0.7 | = | 15.4  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 79.99 | x | 0.63 | x | 0.7 | = | 22.98 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 79.99 | x | 0.63 | x | 0.7 | = | 61.11 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 79.99 | x | 0.63 | x | 0.7 | = | 61.11 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 74.68 | x | 0.63 | x | 0.7 | = | 14.38 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 74.68 | x | 0.63 | x | 0.7 | = | 14.38 | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 74.68 | x | 0.63 | x | 0.7 | = | 21.45 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 74.68 | x | 0.63 | x | 0.7 | = | 57.06 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 74.68 | x | 0.63 | x | 0.7 | = | 57.06 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 59.25 | x | 0.63 | x | 0.7 | = | 11.41 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 59.25 | x | 0.63 | x | 0.7 | = | 11.41 | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 59.25 | x | 0.63 | x | 0.7 | = | 17.02 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 59.25 | x | 0.63 | x | 0.7 | = | 45.27 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 59.25 | x | 0.63 | x | 0.7 | = | 45.27 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 41.52 | x | 0.63 | x | 0.7 | = | 7.99  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 41.52 | x | 0.63 | x | 0.7 | = | 7.99  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 41.52 | x | 0.63 | x | 0.7 | = | 11.93 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 41.52 | x | 0.63 | x | 0.7 | = | 31.72 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 41.52 | x | 0.63 | x | 0.7 | = | 31.72 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 24.19 | x | 0.63 | x | 0.7 | = | 4.66  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 24.19 | x | 0.63 | x | 0.7 | = | 4.66  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 24.19 | x | 0.63 | x | 0.7 | = | 6.95  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 24.19 | x | 0.63 | x | 0.7 | = | 18.48 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 24.19 | x | 0.63 | x | 0.7 | = | 18.48 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 13.12 | x | 0.63 | x | 0.7 | = | 2.53  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 13.12 | x | 0.63 | x | 0.7 | = | 2.53  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 13.12 | x | 0.63 | x | 0.7 | = | 3.77  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 13.12 | x | 0.63 | x | 0.7 | = | 10.02 | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 13.12 | x | 0.63 | x | 0.7 | = | 10.02 | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 8.86  | x | 0.63 | x | 0.7 | = | 1.71  | (74) |
| North | 0.9x | 0.77 | x | 0.63 | x | 8.86  | x | 0.63 | x | 0.7 | = | 1.71  | (74) |
| North | 0.9x | 0.77 | x | 0.94 | x | 8.86  | x | 0.63 | x | 0.7 | = | 2.55  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 8.86  | x | 0.63 | x | 0.7 | = | 6.77  | (74) |
| North | 0.9x | 0.77 | x | 2.5  | x | 8.86  | x | 0.63 | x | 0.7 | = | 6.77  | (74) |
| East  | 0.9x | 0.77 | x | 2    | x | 19.64 | x | 0.63 | x | 0.7 | = | 12    | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 19.64 | x | 0.63 | x | 0.7 | = | 12    | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 19.64 | x | 0.63 | x | 0.7 | = | 5.64  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 38.42 | x | 0.63 | x | 0.7 | = | 23.48 | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 38.42 | x | 0.63 | x | 0.7 | = | 23.48 | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 38.42 | x | 0.63 | x | 0.7 | = | 11.04 | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 63.27 | x | 0.63 | x | 0.7 | = | 38.67 | (76) |

## DER WorkSheet: New dwelling design stage

|       |      |      |   |      |   |        |   |      |   |     |   |        |      |
|-------|------|------|---|------|---|--------|---|------|---|-----|---|--------|------|
| East  | 0.9x | 0.77 | x | 2    | x | 63.27  | x | 0.63 | x | 0.7 | = | 38.67  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 63.27  | x | 0.63 | x | 0.7 | = | 18.18  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 92.28  | x | 0.63 | x | 0.7 | = | 56.4   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 92.28  | x | 0.63 | x | 0.7 | = | 56.4   | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 92.28  | x | 0.63 | x | 0.7 | = | 26.51  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 113.09 | x | 0.63 | x | 0.7 | = | 69.13  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 113.09 | x | 0.63 | x | 0.7 | = | 69.13  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 113.09 | x | 0.63 | x | 0.7 | = | 32.49  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 115.77 | x | 0.63 | x | 0.7 | = | 70.76  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 115.77 | x | 0.63 | x | 0.7 | = | 70.76  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 115.77 | x | 0.63 | x | 0.7 | = | 33.26  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 110.22 | x | 0.63 | x | 0.7 | = | 67.37  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 110.22 | x | 0.63 | x | 0.7 | = | 67.37  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 110.22 | x | 0.63 | x | 0.7 | = | 31.66  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 94.68  | x | 0.63 | x | 0.7 | = | 57.87  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 94.68  | x | 0.63 | x | 0.7 | = | 57.87  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 94.68  | x | 0.63 | x | 0.7 | = | 27.2   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 73.59  | x | 0.63 | x | 0.7 | = | 44.98  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 73.59  | x | 0.63 | x | 0.7 | = | 44.98  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 73.59  | x | 0.63 | x | 0.7 | = | 21.14  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 45.59  | x | 0.63 | x | 0.7 | = | 27.87  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 45.59  | x | 0.63 | x | 0.7 | = | 27.87  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 45.59  | x | 0.63 | x | 0.7 | = | 13.1   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 24.49  | x | 0.63 | x | 0.7 | = | 14.97  | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 24.49  | x | 0.63 | x | 0.7 | = | 14.97  | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 24.49  | x | 0.63 | x | 0.7 | = | 7.04   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 16.15  | x | 0.63 | x | 0.7 | = | 9.87   | (76) |
| East  | 0.9x | 0.77 | x | 2    | x | 16.15  | x | 0.63 | x | 0.7 | = | 9.87   | (76) |
| East  | 0.9x | 0.77 | x | 0.94 | x | 16.15  | x | 0.63 | x | 0.7 | = | 4.64   | (76) |
| South | 0.9x | 0.77 | x | 2.25 | x | 46.75  | x | 0.63 | x | 0.7 | = | 32.15  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 46.75  | x | 0.63 | x | 0.7 | = | 32.15  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 46.75  | x | 0.63 | x | 0.7 | = | 30     | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 46.75  | x | 0.63 | x | 0.7 | = | 142.02 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 76.57  | x | 0.63 | x | 0.7 | = | 52.65  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 76.57  | x | 0.63 | x | 0.7 | = | 52.65  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 76.57  | x | 0.63 | x | 0.7 | = | 49.14  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 76.57  | x | 0.63 | x | 0.7 | = | 232.6  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 97.53  | x | 0.63 | x | 0.7 | = | 67.07  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 97.53  | x | 0.63 | x | 0.7 | = | 67.07  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 97.53  | x | 0.63 | x | 0.7 | = | 62.6   | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 97.53  | x | 0.63 | x | 0.7 | = | 296.29 | (78) |

## DER WorkSheet: New dwelling design stage

|       |      |      |   |      |   |        |   |      |   |     |   |        |      |
|-------|------|------|---|------|---|--------|---|------|---|-----|---|--------|------|
| South | 0.9x | 0.77 | x | 2.25 | x | 110.23 | x | 0.63 | x | 0.7 | = | 75.8   | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 110.23 | x | 0.63 | x | 0.7 | = | 75.8   | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 110.23 | x | 0.63 | x | 0.7 | = | 70.75  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 110.23 | x | 0.63 | x | 0.7 | = | 334.87 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 114.87 | x | 0.63 | x | 0.7 | = | 78.99  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 114.87 | x | 0.63 | x | 0.7 | = | 78.99  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 114.87 | x | 0.63 | x | 0.7 | = | 73.72  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 114.87 | x | 0.63 | x | 0.7 | = | 348.95 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 110.55 | x | 0.63 | x | 0.7 | = | 76.02  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 110.55 | x | 0.63 | x | 0.7 | = | 76.02  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 110.55 | x | 0.63 | x | 0.7 | = | 70.95  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 110.55 | x | 0.63 | x | 0.7 | = | 335.82 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 108.01 | x | 0.63 | x | 0.7 | = | 74.27  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 108.01 | x | 0.63 | x | 0.7 | = | 74.27  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 108.01 | x | 0.63 | x | 0.7 | = | 69.32  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 108.01 | x | 0.63 | x | 0.7 | = | 328.12 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 104.89 | x | 0.63 | x | 0.7 | = | 72.13  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 104.89 | x | 0.63 | x | 0.7 | = | 72.13  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 104.89 | x | 0.63 | x | 0.7 | = | 67.32  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 104.89 | x | 0.63 | x | 0.7 | = | 318.65 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 101.89 | x | 0.63 | x | 0.7 | = | 70.06  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 101.89 | x | 0.63 | x | 0.7 | = | 70.06  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 101.89 | x | 0.63 | x | 0.7 | = | 65.39  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 101.89 | x | 0.63 | x | 0.7 | = | 309.51 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 82.59  | x | 0.63 | x | 0.7 | = | 56.79  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 82.59  | x | 0.63 | x | 0.7 | = | 56.79  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 82.59  | x | 0.63 | x | 0.7 | = | 53     | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 82.59  | x | 0.63 | x | 0.7 | = | 250.88 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 55.42  | x | 0.63 | x | 0.7 | = | 38.11  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 55.42  | x | 0.63 | x | 0.7 | = | 38.11  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 55.42  | x | 0.63 | x | 0.7 | = | 35.57  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 55.42  | x | 0.63 | x | 0.7 | = | 168.35 | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 40.4   | x | 0.63 | x | 0.7 | = | 27.78  | (78) |
| South | 0.9x | 0.77 | x | 2.25 | x | 40.4   | x | 0.63 | x | 0.7 | = | 27.78  | (78) |
| South | 0.9x | 0.77 | x | 2.1  | x | 40.4   | x | 0.63 | x | 0.7 | = | 25.93  | (78) |
| South | 0.9x | 0.77 | x | 9.94 | x | 40.4   | x | 0.63 | x | 0.7 | = | 122.72 | (78) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 19.64  | x | 0.63 | x | 0.7 | = | 5.64   | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 38.42  | x | 0.63 | x | 0.7 | = | 11.04  | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 63.27  | x | 0.63 | x | 0.7 | = | 18.18  | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 92.28  | x | 0.63 | x | 0.7 | = | 26.51  | (80) |
| West  | 0.9x | 0.77 | x | 0.94 | x | 113.09 | x | 0.63 | x | 0.7 | = | 32.49  | (80) |

## DER WorkSheet: New dwelling design stage

|      |      |      |   |      |   |        |   |      |   |     |   |       |      |
|------|------|------|---|------|---|--------|---|------|---|-----|---|-------|------|
| West | 0.9x | 0.77 | x | 0.94 | x | 115.77 | x | 0.63 | x | 0.7 | = | 33.26 | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 110.22 | x | 0.63 | x | 0.7 | = | 31.66 | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 94.68  | x | 0.63 | x | 0.7 | = | 27.2  | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 73.59  | x | 0.63 | x | 0.7 | = | 21.14 | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 45.59  | x | 0.63 | x | 0.7 | = | 13.1  | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 24.49  | x | 0.63 | x | 0.7 | = | 7.04  | (80) |
| West | 0.9x | 0.77 | x | 0.94 | x | 16.15  | x | 0.63 | x | 0.7 | = | 4.64  | (80) |

Solar gains in watts, calculated for each month

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

|        |        |        |       |        |        |        |        |        |        |        |     |        |      |
|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|-----|--------|------|
| (83)m= | 295.02 | 500.79 | 682.7 | 845.09 | 948.29 | 942.84 | 908.36 | 830.72 | 738.61 | 552.61 | 353 | 252.74 | (83) |
|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|-----|--------|------|

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

|        |        |         |         |         |         |         |         |         |         |         |        |        |      |
|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|------|
| (84)m= | 820.33 | 1023.85 | 1188.31 | 1322.22 | 1395.86 | 1362.38 | 1309.97 | 1238.91 | 1161.67 | 1004.39 | 837.83 | 762.98 | (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   | 0.99 | 0.98 | 0.95 | 0.88 | 0.73 | 0.57 | 0.61 | 0.84 | 0.97 | 1   | 1   | (86) |

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

|        |       |       |       |       |       |      |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|------|
| (87)m= | 20.46 | 20.51 | 20.58 | 20.67 | 20.75 | 20.8 | 20.82 | 20.82 | 20.78 | 20.68 | 20.55 | 20.45 | (87) |
|--------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (88)m= | 19.83 | 19.83 | 19.83 | 19.84 | 19.84 | 19.85 | 19.85 | 19.85 | 19.85 | 19.84 | 19.84 | 19.84 | (88) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

|        |   |      |      |      |      |      |      |      |      |      |      |   |      |
|--------|---|------|------|------|------|------|------|------|------|------|------|---|------|
| (89)m= | 1 | 0.99 | 0.98 | 0.94 | 0.83 | 0.63 | 0.43 | 0.48 | 0.76 | 0.96 | 0.99 | 1 | (89) |
|--------|---|------|------|------|------|------|------|------|------|------|------|---|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (90)m= | 19.08 | 19.16 | 19.27 | 19.41 | 19.52 | 19.58 | 19.59 | 19.59 | 19.56 | 19.42 | 19.23 | 19.08 | (90) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

fLA = Living area ÷ (4) =

0.14 (91)

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (92)m= | 19.27 | 19.34 | 19.45 | 19.58 | 19.68 | 19.75 | 19.76 | 19.76 | 19.73 | 19.59 | 19.41 | 19.26 | (92) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

|        |       |       |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (93)m= | 19.27 | 19.34 | 19.45 | 19.58 | 19.68 | 19.75 | 19.76 | 19.76 | 19.73 | 19.59 | 19.41 | 19.26 | (93) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

### 8. Space heating requirement

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

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

Utilisation factor for gains, hm:

|        |   |      |      |      |      |      |      |      |      |      |      |   |      |
|--------|---|------|------|------|------|------|------|------|------|------|------|---|------|
| (94)m= | 1 | 0.99 | 0.98 | 0.93 | 0.82 | 0.62 | 0.42 | 0.47 | 0.75 | 0.95 | 0.99 | 1 | (94) |
|--------|---|------|------|------|------|------|------|------|------|------|------|---|------|

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

|        |        |         |         |         |         |       |        |        |        |        |       |        |      |
|--------|--------|---------|---------|---------|---------|-------|--------|--------|--------|--------|-------|--------|------|
| (95)m= | 817.62 | 1014.39 | 1159.23 | 1231.82 | 1150.43 | 849.6 | 546.23 | 576.37 | 869.43 | 954.86 | 831.2 | 761.16 | (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= | 2684.88 | 2584.96 | 2312.33 | 1888.01 | 1408.4 | 899.73 | 552.26 | 586.33 | 986.78 | 1585.77 | 2179.74 | 2678.8 | (97) |
|--------|---------|---------|---------|---------|--------|--------|--------|--------|--------|---------|---------|--------|------|

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

|        |         |         |        |        |        |   |   |   |   |       |        |         |  |
|--------|---------|---------|--------|--------|--------|---|---|---|---|-------|--------|---------|--|
| (98)m= | 1389.24 | 1055.42 | 857.91 | 472.45 | 191.93 | 0 | 0 | 0 | 0 | 469.4 | 970.95 | 1426.72 |  |
|--------|---------|---------|--------|--------|--------|---|---|---|---|-------|--------|---------|--|

# DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> = 6834.01 (98)

Space heating requirement in kWh/m<sup>2</sup>/year 50.21 (99)

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

### Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.6 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

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

Space heating requirement (calculated above)

|         |         |        |        |        |   |   |   |   |       |        |         |  |
|---------|---------|--------|--------|--------|---|---|---|---|-------|--------|---------|--|
| 1389.24 | 1055.42 | 857.91 | 472.45 | 191.93 | 0 | 0 | 0 | 0 | 469.4 | 970.95 | 1426.72 |  |
|---------|---------|--------|--------|--------|---|---|---|---|-------|--------|---------|--|

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

|         |         |        |        |        |   |   |   |   |       |         |         |  |
|---------|---------|--------|--------|--------|---|---|---|---|-------|---------|---------|--|
| 1533.37 | 1164.92 | 946.92 | 521.47 | 211.84 | 0 | 0 | 0 | 0 | 518.1 | 1071.69 | 1574.75 |  |
|---------|---------|--------|--------|--------|---|---|---|---|-------|---------|---------|--|

Total (kWh/year) = Sum(211)<sub>1...5,10...12</sub> = 7543.06 (211)

Space heating fuel (secondary), kWh/month

= {[ (98)m × (201)] } × 100 ÷ (208)

(215)m=

|   |   |   |   |   |   |   |   |   |   |   |   |  |
|---|---|---|---|---|---|---|---|---|---|---|---|--|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
|---|---|---|---|---|---|---|---|---|---|---|---|--|

Total (kWh/year) = Sum(215)<sub>1...5,10...12</sub> = 0 (215)

### Water heating

Output from water heater (calculated above)

|        |        |        |        |        |        |        |        |        |        |        |        |  |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| 213.36 | 187.89 | 196.93 | 175.99 | 172.07 | 153.19 | 146.58 | 161.59 | 161.54 | 182.52 | 193.68 | 208.04 |  |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

Efficiency of water heater 79.9 (216)

(217)m= 89.01 88.8 88.39 87.42 85.21 79.9 79.9 79.9 79.9 87.33 88.63 89.08 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=

|        |        |       |        |        |        |        |        |        |        |        |        |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| 239.69 | 211.58 | 222.8 | 201.31 | 201.95 | 191.73 | 183.46 | 202.24 | 202.17 | 209.01 | 218.54 | 233.54 |  |
|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|

Total = Sum(219a)<sub>1...12</sub> = 2518.02 (219)

### Annual totals

Space heating fuel used, main system 1

kWh/year 7543.06

Water heating fuel used

2518.02

Electricity for pumps, fans and electric keep-hot

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 480.45 (232)

Electricity generated by PVs -3454.48 (233)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 7162.05 (338)

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

## DER WorkSheet: New dwelling design stage

|                                                   | Energy<br>kWh/year              | Emission factor<br>kg CO2/kWh |   | Emissions<br>kg CO2/year |
|---------------------------------------------------|---------------------------------|-------------------------------|---|--------------------------|
| Space heating (main system 1)                     | (211) x                         | 0.216                         | = | 1629.3 (261)             |
| Space heating (secondary)                         | (215) x                         | 0.519                         | = | 0 (263)                  |
| Water heating                                     | (219) x                         | 0.216                         | = | 543.89 (264)             |
| Space and water heating                           | (261) + (262) + (263) + (264) = |                               |   | 2173.19 (265)            |
| Electricity for pumps, fans and electric keep-hot | (231) x                         | 0.519                         | = | 38.93 (267)              |
| Electricity for lighting                          | (232) x                         | 0.519                         | = | 249.35 (268)             |
| Energy saving/generation technologies<br>Item 1   |                                 | 0.519                         | = | -1792.87 (269)           |
| Total CO2, kg/year                                | sum of (265)...(271) =          |                               |   | 668.6 (272)              |
| <b>Dwelling CO2 Emission Rate</b>                 | (272) ÷ (4) =                   |                               |   | 4.91 (273)               |
| El rating (section 14)                            |                                 |                               |   | 95 (274)                 |