

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.58
Printed on 29 November 2022 at 15:09:52

Project Information:

Assessed By: Liam Mason (STRO033679) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 72.5m²

Site Reference : Bell Road, Bottisham

Plot Reference: Plot 17

Address : Plot 17

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) 18.2 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 7.93 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 47.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 43.4 kWh/m² **OK**

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|-----------|
| External wall | 0.19 (max. 0.30) | 0.19 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.11 (max. 0.25) | 0.11 (max. 0.70) | OK |
| Roof | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.36 (max. 2.00) | 1.40 (max. 3.30) | OK |

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: Database: (rev 508, product index 016841):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC plus 824
Model qualifier: VUW GB 246/5-5 (Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

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5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
Hot water controls: No cylinder thermostat

No cylinder
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 (East Anglia): Slight **OK**

Based on:

Overshading: Average or unknown
Windows facing: North 1.17m²
Windows facing: North 1.12m²
Windows facing: East 0.39m²
Windows facing: South 2.98m²
Windows facing: East 0.39m²
Windows facing: South 1.14m²
Windows facing: South 1.25m²
Ventilation rate: 3.00
Blinds/curtains: Dark-coloured curtain or roller blind
Closed 100% of daylight hours

10 Key features

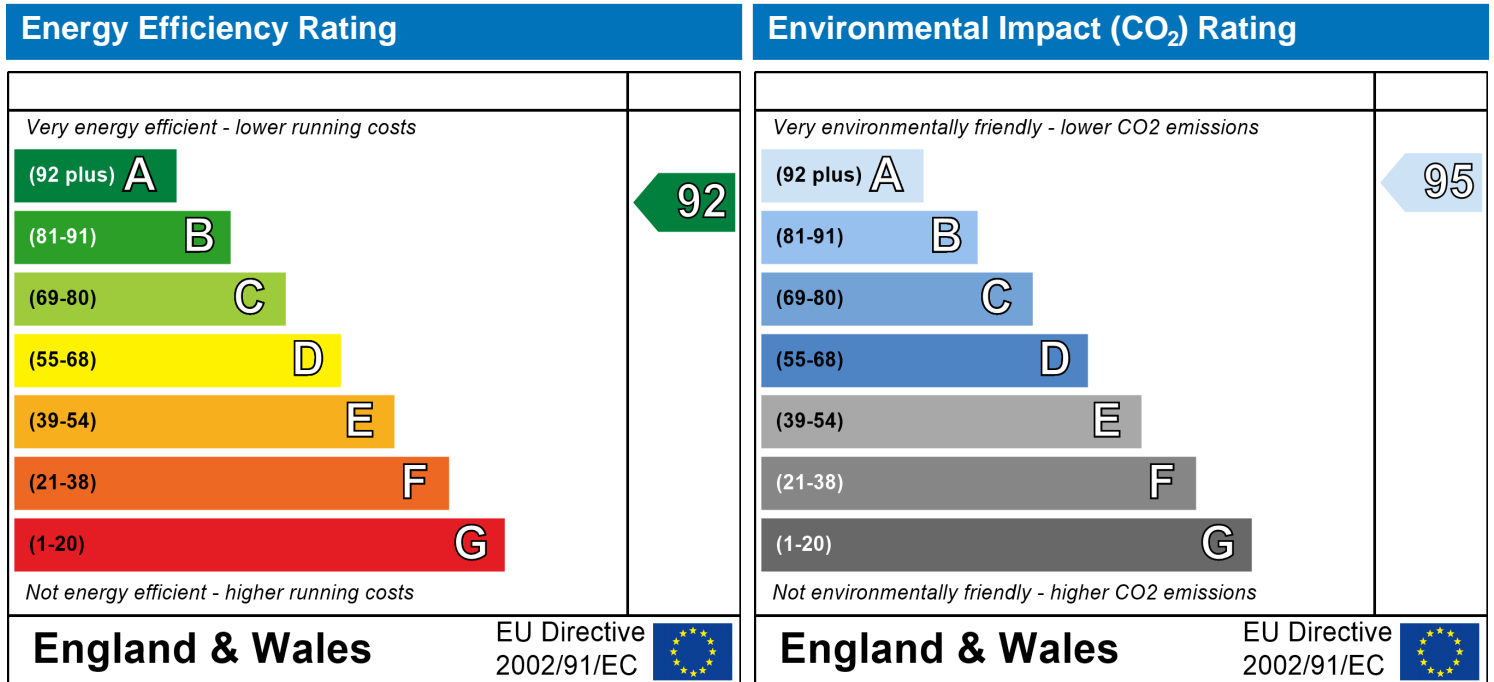
Roofs U-value 0.11 W/m²K
Party Walls U-value 0 W/m²K
Floors U-value 0.11 W/m²K
Photovoltaic array

Plot 17

Dwelling type: Semi-detached House
 Date of assessment: 03 November 2022
 Produced by: Liam Mason
 Total floor area: 72.5 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: Plot 17

Address: Plot 17
 Located in: England
 Region: East Anglia
 UPRN:
 Date of assessment: 03 November 2022
 Date of certificate: 29 November 2022
 Assessment type: New dwelling design stage
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Indicative Value Low
 Water use <= 125 litres/person/day: True
 PCDF Version: 508

Property description:

Dwelling type: House
 Detachment: Semi-detached
 Year Completed: 2022
 Floor Location: Floor area: Storey height:
 Floor 0 36.25 m² 2.4 m
 Floor 1 36.25 m² 2.4 m
 Living area: 12.61 m² (fraction 0.174)
 Front of dwelling faces: North

Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|-------|--------------|---------|-----------------------------|--------|--------|
| D_1 | Manufacturer | Solid | | | |
| W_1 | Manufacturer | Windows | low-E, En = 0.05, soft coat | Yes | |
| W_2 | Manufacturer | Windows | low-E, En = 0.05, soft coat | Yes | |
| W_3 | Manufacturer | Windows | low-E, En = 0.05, soft coat | Yes | |
| W_4 | Manufacturer | Windows | low-E, En = 0.05, soft coat | Yes | |
| W_5 | Manufacturer | Windows | low-E, En = 0.05, soft coat | Yes | |
| W_6 | Manufacturer | Windows | low-E, En = 0.05, soft coat | Yes | |
| W_7 | Manufacturer | Windows | low-E, En = 0.05, soft coat | Yes | |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|-------|--------------|---------------|----------|----------|-------|------------------|
| D_1 | mm | 0 | 0 | 1.2 | 1.83 | 1 |
| W_1 | 16mm or more | 0.7 | 0.63 | 1.4 | 1.17 | 1 |
| W_2 | 16mm or more | 0.7 | 0.63 | 1.4 | 1.12 | 1 |
| W_3 | 16mm or more | 0.7 | 0.63 | 1.4 | 0.39 | 1 |
| W_4 | 16mm or more | 0.7 | 0.63 | 1.4 | 2.98 | 1 |
| W_5 | 16mm or more | 0.7 | 0.63 | 1.4 | 0.39 | 1 |
| W_6 | 16mm or more | 0.7 | 0.63 | 1.4 | 1.14 | 1 |
| W_7 | 16mm or more | 0.7 | 0.63 | 1.4 | 1.25 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|-------|------------|-----------|---------|--------|---------|
| D_1 | Doors | Wall 1 | North | 1.83 | 1 |
| W_1 | Windows | Wall 1 | North | 1.17 | 1 |
| W_2 | Windows | Wall 1 | North | 1.12 | 1 |
| W_3 | Windows | Wall 1 | East | 0.39 | 1 |
| W_4 | Windows | Wall 1 | South | 2.98 | 1 |
| W_5 | Windows | Wall 1 | East | 0.39 | 1 |
| W_6 | Windows | Wall 1 | South | 1.14 | 1 |
| W_7 | Windows | Wall 1 | South | 1.25 | 1 |

SAP Input

Overshading: Average or unknown

Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|--------------------------|-------------|-----------|-----------|----------|-----------|---------------|--------|
| <u>External Elements</u> | | | | | | | |
| Wall 1 | 84.02 | 10.27 | 73.75 | 0.19 | 0 | False | N/A |
| Roof 1 | 36.25 | 0 | 36.25 | 0.11 | 0 | | N/A |
| Floor 1 | 36.25 | | | 0.11 | | | N/A |
| <u>Internal Elements</u> | | | | | | | |
| INT FLOOR | 36.25 | | | | | | N/A |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 39.42 | | | | | | N/A |

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0885

| Length | Psi-value | | |
|--------|-----------|-----|---|
| 17.06 | 0.16 | E5 | Ground floor (normal) |
| 17.06 | 0.07 | E6 | Intermediate floor within a dwelling |
| 9.85 | 0.09 | E16 | Corner (normal) |
| 8 | 0.3 | E2 | Other lintels (including other steel lintels) |
| 7.07 | 0.04 | E3 | Sill |
| 17.4 | 0.05 | E4 | Jamb |
| 9.06 | 0.06 | E10 | Eaves (insulation at ceiling level) |
| 11.29 | 0.24 | E12 | Gable (insulation at ceiling level) |
| 9.85 | 0.06 | E18 | Party wall between dwellings |
| 0 | 0.3 | E2 | |
| 0 | 0.04 | E3 | |
| 0 | 0.05 | E4 | |
| 0 | 0.16 | E5 | |
| 0 | 0.07 | E6 | |
| 0 | 0.06 | E10 | |
| 0 | 0.24 | E12 | |
| 0 | 0.09 | E16 | |
| 0 | -0.09 | E17 | |
| 0 | 0.06 | E18 | |
| 8 | 0.16 | P1 | Ground floor |
| 8 | 0 | P2 | Intermediate floor within a dwelling |
| 0 | 0.16 | P1 | |
| 0 | 0 | P2 | |
| 4.53 | 0.08 | R4 | Ridge (vaulted ceiling) |
| 0 | 0.08 | R4 | |

Ventilation:

| | |
|----------------------------|------------------------------------|
| Pressure test: | Yes (As designed) |
| Ventilation: | Natural ventilation (extract fans) |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 2 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 5 |

Main heating system:

| | |
|----------------------|---|
| Main heating system: | Boiler systems with radiators or underfloor heating |
| | Gas boilers and oil boilers |
| | Fuel: mains gas |
| | Info Source: Boiler Database |

SAP Input

Database: (rev 508, product index 016841) Efficiency: Winter 87.0 % Summer: 90.0
Brand name: Vaillant
Model: ecoTEC plus 824
Model qualifier: VUW GB 246/5-5
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature <=45°C
Unknown
Boiler interlock: Yes
Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 1.5
Tilt of collector: 45°
Overshading: None or very little
Collector Orientation: South
Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|-----------------------|------------------|--------------------------|-------------------|
| Assessor Name: | Liam Mason | Stroma Number: | STRO033679 |
| Software Name: | Stroma FSAP 2012 | Software Version: | Version: 1.0.5.58 |

Property Address: Plot 17

Address : Plot 17

1. Overall dwelling dimensions:

| | Area(m ²) | | Av. Height(m) | | Volume(m ³) |
|---|-----------------------|--------|---------------|--------------------------------------|-------------------------|
| Ground floor | 36.25 | (1a) x | 2.4 | (2a) = | 87 (3a) |
| First floor | 36.25 | (1b) x | 2.4 | (2b) = | 87 (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 72.5 | (4) | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 174 (5) |

2. Ventilation rate:

| | main heating | | secondary heating | | other | | total | | m ³ per hour |
|------------------------------|--------------|---|-------------------|---|-------|---|-------|--------|-------------------------|
| Number of chimneys | 0 | + | 0 | + | 0 | = | 0 | x 40 = | 0 (6a) |
| Number of open flues | 0 | + | 0 | + | 0 | = | 0 | x 20 = | 0 (6b) |
| Number of intermittent fans | | | | | | | 2 | x 10 = | 20 (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) = | 20 | ÷ (5) = | 0.11 (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 <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> | | | 0 (11) |
| 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) | | | 0.36 (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) = | | 0.31 (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|--------|-----|---|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
|--------|-----|---|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|

SAP WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.85 (36)

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

Total fabric heat loss (33) + (36) = 49.22 (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= | 33.2 | 33.03 | 32.86 | 32.05 | 31.9 | 31.2 | 31.2 | 31.07 | 31.47 | 31.9 | 32.21 | 32.52 | (38) |

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

| | | | | | | | | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|------|------|-------|-------|------------|--|
| (39)m= | 82.42 | 82.25 | 82.08 | 81.28 | 81.13 | 80.43 | 80.43 | 80.3 | 80.7 | 81.13 | 81.43 | 81.75 | |
| Average = Sum(39) _{1...12} /12= | | | | | | | | | | | | 81.27 (39) | |

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

| | | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|-----------|--|
| (40)m= | 1.14 | 1.13 | 1.13 | 1.12 | 1.12 | 1.11 | 1.11 | 1.11 | 1.11 | 1.12 | 1.12 | 1.13 | |
| Average = Sum(40) _{1...12} /12= | | | | | | | | | | | | 1.12 (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 2.31 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.95 (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 | |
|-------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------|--|
| (44)m= | 97.84 | 94.29 | 90.73 | 87.17 | 83.61 | 80.05 | 80.05 | 83.61 | 87.17 | 90.73 | 94.29 | 97.84 | |
| Total = Sum(44) _{1...12} = | | | | | | | | | | | | 1067.4 (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= | 145.1 | 126.91 | 130.96 | 114.17 | 109.55 | 94.53 | 87.6 | 100.52 | 101.72 | 118.55 | 129.4 | 140.52 | |
| Total = Sum(45) _{1...12} = | | | | | | | | | | | | 1399.53 (45) | |

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

(46)m=

| | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 21.77 | 19.04 | 19.64 | 17.13 | 16.43 | 14.18 | 13.14 | 15.08 | 15.26 | 17.78 | 19.41 | 21.08 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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)

SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$

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

 (54)
 Enter (50) or (54) in (55)

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

 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$
 (56)m=

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

 (56)

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, 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 $(59)m = (58) \div 365 \times (41)m$
 (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 $(61)m = (60) \div 365 \times (41)m$
 (61)m=

| | | | | | | | | | | | |
|-------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|------|
| 25.82 | 23.29 | 25.75 | 24.87 | 25.67 | 24.8 | 25.6 | 25.64 | 24.84 | 25.72 | 24.94 | 25.8 |
|-------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|------|

 (61)

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

| | | | | | | | | | | | |
|--------|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|
| 170.92 | 150.2 | 156.7 | 139.04 | 135.22 | 119.33 | 113.2 | 126.17 | 126.56 | 144.26 | 154.34 | 166.33 |
|--------|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|

 (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 FGHRHS and/or WWHRHS 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=

| | | | | | | | | | | | |
|--------|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|
| 170.92 | 150.2 | 156.7 | 139.04 | 135.22 | 119.33 | 113.2 | 126.17 | 126.56 | 144.26 | 154.34 | 166.33 |
|--------|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|

 $\text{Output from water heater (annual)}_{1...12}$

| |
|---------|
| 1702.27 |
|---------|

 (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=

| | | | | | | | | | | | |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 54.7 | 48.02 | 49.98 | 44.18 | 42.84 | 37.63 | 35.53 | 39.83 | 40.03 | 45.85 | 49.26 | 53.17 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

 (65)

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

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

Metabolic gains (Table 5), Watts
 (66)m=

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 | 138.32 |

 (66)

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

| | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|
| 50.57 | 44.92 | 36.53 | 27.66 | 20.67 | 17.45 | 18.86 | 24.51 | 32.9 | 41.78 | 48.76 | 51.98 |
|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|

 (67)

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

| | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| 303.07 | 306.22 | 298.29 | 281.42 | 260.13 | 240.11 | 226.74 | 223.59 | 231.52 | 248.39 | 269.69 | 289.7 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|

 (68)

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

| | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 51.14 | 51.14 | 51.14 | 51.14 | 51.14 | 51.14 | 51.14 | 51.14 | 51.14 | 51.14 | 51.14 | 51.14 |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

 (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=

| | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| -92.21 | -92.21 | -92.21 | -92.21 | -92.21 | -92.21 | -92.21 | -92.21 | -92.21 | -92.21 | -92.21 | -92.21 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

 (71)

Water heating gains (Table 5)
 (72)m=

| | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|
| 73.52 | 71.46 | 67.18 | 61.36 | 57.58 | 52.27 | 47.75 | 53.54 | 55.6 | 61.62 | 68.42 | 71.47 |
|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|

 (72)

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

| | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|
| 527.41 | 522.84 | 502.24 | 470.68 | 438.62 | 410.07 | 393.59 | 401.89 | 420.26 | 452.02 | 487.1 | 513.39 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|

 (73)

6. Solar gains:

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

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| Orientation: | Access Factor Table 6d | Area m ² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|--------------|---------------------------|------------------------|------------------|----------------|----------------|--------------|
| North | 0.9x | 1.17 | 10.63 | 0.63 | 0.7 | 3.8 (74) |
| North | 0.9x | 1.12 | 10.63 | 0.63 | 0.7 | 3.64 (74) |
| North | 0.9x | 1.17 | 20.32 | 0.63 | 0.7 | 7.27 (74) |
| North | 0.9x | 1.12 | 20.32 | 0.63 | 0.7 | 6.96 (74) |
| North | 0.9x | 1.17 | 34.53 | 0.63 | 0.7 | 12.35 (74) |
| North | 0.9x | 1.12 | 34.53 | 0.63 | 0.7 | 11.82 (74) |
| North | 0.9x | 1.17 | 55.46 | 0.63 | 0.7 | 19.83 (74) |
| North | 0.9x | 1.12 | 55.46 | 0.63 | 0.7 | 18.98 (74) |
| North | 0.9x | 1.17 | 74.72 | 0.63 | 0.7 | 26.72 (74) |
| North | 0.9x | 1.12 | 74.72 | 0.63 | 0.7 | 25.57 (74) |
| North | 0.9x | 1.17 | 79.99 | 0.63 | 0.7 | 28.6 (74) |
| North | 0.9x | 1.12 | 79.99 | 0.63 | 0.7 | 27.38 (74) |
| North | 0.9x | 1.17 | 74.68 | 0.63 | 0.7 | 26.7 (74) |
| North | 0.9x | 1.12 | 74.68 | 0.63 | 0.7 | 25.56 (74) |
| North | 0.9x | 1.17 | 59.25 | 0.63 | 0.7 | 21.18 (74) |
| North | 0.9x | 1.12 | 59.25 | 0.63 | 0.7 | 20.28 (74) |
| North | 0.9x | 1.17 | 41.52 | 0.63 | 0.7 | 14.84 (74) |
| North | 0.9x | 1.12 | 41.52 | 0.63 | 0.7 | 14.21 (74) |
| North | 0.9x | 1.17 | 24.19 | 0.63 | 0.7 | 8.65 (74) |
| North | 0.9x | 1.12 | 24.19 | 0.63 | 0.7 | 8.28 (74) |
| North | 0.9x | 1.17 | 13.12 | 0.63 | 0.7 | 4.69 (74) |
| North | 0.9x | 1.12 | 13.12 | 0.63 | 0.7 | 4.49 (74) |
| North | 0.9x | 1.17 | 8.86 | 0.63 | 0.7 | 3.17 (74) |
| North | 0.9x | 1.12 | 8.86 | 0.63 | 0.7 | 3.03 (74) |
| East | 0.9x | 0.39 | 19.64 | 0.63 | 0.7 | 2.34 (76) |
| East | 0.9x | 0.39 | 19.64 | 0.63 | 0.7 | 2.34 (76) |
| East | 0.9x | 0.39 | 38.42 | 0.63 | 0.7 | 4.58 (76) |
| East | 0.9x | 0.39 | 38.42 | 0.63 | 0.7 | 4.58 (76) |
| East | 0.9x | 0.39 | 63.27 | 0.63 | 0.7 | 7.54 (76) |
| East | 0.9x | 0.39 | 63.27 | 0.63 | 0.7 | 7.54 (76) |
| East | 0.9x | 0.39 | 92.28 | 0.63 | 0.7 | 11 (76) |
| East | 0.9x | 0.39 | 92.28 | 0.63 | 0.7 | 11 (76) |
| East | 0.9x | 0.39 | 113.09 | 0.63 | 0.7 | 13.48 (76) |
| East | 0.9x | 0.39 | 113.09 | 0.63 | 0.7 | 13.48 (76) |
| East | 0.9x | 0.39 | 115.77 | 0.63 | 0.7 | 13.8 (76) |
| East | 0.9x | 0.39 | 115.77 | 0.63 | 0.7 | 13.8 (76) |
| East | 0.9x | 0.39 | 110.22 | 0.63 | 0.7 | 13.14 (76) |
| East | 0.9x | 0.39 | 110.22 | 0.63 | 0.7 | 13.14 (76) |
| East | 0.9x | 0.39 | 94.68 | 0.63 | 0.7 | 11.28 (76) |

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| | | | | | | | | | | | | | |
|-------|------|------|---|------|---|--------|---|------|---|-----|---|--------|------|
| East | 0.9x | 0.77 | x | 0.39 | x | 94.68 | x | 0.63 | x | 0.7 | = | 11.28 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 73.59 | x | 0.63 | x | 0.7 | = | 8.77 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 73.59 | x | 0.63 | x | 0.7 | = | 8.77 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 45.59 | x | 0.63 | x | 0.7 | = | 5.43 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 45.59 | x | 0.63 | x | 0.7 | = | 5.43 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 24.49 | x | 0.63 | x | 0.7 | = | 2.92 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 24.49 | x | 0.63 | x | 0.7 | = | 2.92 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 16.15 | x | 0.63 | x | 0.7 | = | 1.93 | (76) |
| East | 0.9x | 0.77 | x | 0.39 | x | 16.15 | x | 0.63 | x | 0.7 | = | 1.93 | (76) |
| South | 0.9x | 0.77 | x | 2.98 | x | 46.75 | x | 0.63 | x | 0.7 | = | 42.58 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 46.75 | x | 0.63 | x | 0.7 | = | 16.29 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 46.75 | x | 0.63 | x | 0.7 | = | 17.86 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 76.57 | x | 0.63 | x | 0.7 | = | 69.73 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 76.57 | x | 0.63 | x | 0.7 | = | 26.68 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 76.57 | x | 0.63 | x | 0.7 | = | 29.25 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 97.53 | x | 0.63 | x | 0.7 | = | 88.83 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 97.53 | x | 0.63 | x | 0.7 | = | 33.98 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 97.53 | x | 0.63 | x | 0.7 | = | 37.26 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 110.23 | x | 0.63 | x | 0.7 | = | 100.39 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 110.23 | x | 0.63 | x | 0.7 | = | 38.41 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 110.23 | x | 0.63 | x | 0.7 | = | 42.11 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 114.87 | x | 0.63 | x | 0.7 | = | 104.62 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 114.87 | x | 0.63 | x | 0.7 | = | 40.02 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 114.87 | x | 0.63 | x | 0.7 | = | 43.88 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 110.55 | x | 0.63 | x | 0.7 | = | 100.68 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 110.55 | x | 0.63 | x | 0.7 | = | 38.51 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 110.55 | x | 0.63 | x | 0.7 | = | 42.23 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 108.01 | x | 0.63 | x | 0.7 | = | 98.37 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 108.01 | x | 0.63 | x | 0.7 | = | 37.63 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 108.01 | x | 0.63 | x | 0.7 | = | 41.26 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 104.89 | x | 0.63 | x | 0.7 | = | 95.53 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 104.89 | x | 0.63 | x | 0.7 | = | 36.55 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 104.89 | x | 0.63 | x | 0.7 | = | 40.07 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 101.89 | x | 0.63 | x | 0.7 | = | 92.79 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 101.89 | x | 0.63 | x | 0.7 | = | 35.5 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 101.89 | x | 0.63 | x | 0.7 | = | 38.92 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 82.59 | x | 0.63 | x | 0.7 | = | 75.21 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 82.59 | x | 0.63 | x | 0.7 | = | 28.77 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 82.59 | x | 0.63 | x | 0.7 | = | 31.55 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 55.42 | x | 0.63 | x | 0.7 | = | 50.47 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 55.42 | x | 0.63 | x | 0.7 | = | 19.31 | (78) |

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| | | | | | | | | | | | | | |
|-------|------|------|---|------|---|-------|---|------|---|-----|---|-------|------|
| South | 0.9x | 0.77 | x | 1.25 | x | 55.42 | x | 0.63 | x | 0.7 | = | 21.17 | (78) |
| South | 0.9x | 0.77 | x | 2.98 | x | 40.4 | x | 0.63 | x | 0.7 | = | 36.79 | (78) |
| South | 0.9x | 0.77 | x | 1.14 | x | 40.4 | x | 0.63 | x | 0.7 | = | 14.07 | (78) |
| South | 0.9x | 0.77 | x | 1.25 | x | 40.4 | x | 0.63 | x | 0.7 | = | 15.43 | (78) |

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

| | | | | | | | | | | | | | |
|--------|-------|--------|--------|--------|--------|-----|-------|--------|--------|--------|--------|-------|------|
| (83)m= | 88.85 | 149.04 | 199.32 | 241.72 | 267.77 | 265 | 255.8 | 236.18 | 213.81 | 163.33 | 105.97 | 76.35 | (83) |
|--------|-------|--------|--------|--------|--------|-----|-------|--------|--------|--------|--------|-------|------|

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

| | | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| (84)m= | 616.26 | 671.88 | 701.56 | 712.41 | 706.39 | 675.07 | 649.39 | 638.07 | 634.07 | 615.36 | 593.07 | 589.75 | (84) |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|

7. Mean internal temperature (heating season)

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

| | |
|----|------|
| 21 | (85) |
|----|------|

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

| | | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
| (86)m= | 0.93 | 0.91 | 0.88 | 0.83 | 0.75 | 0.62 | 0.49 | 0.51 | 0.68 | 0.83 | 0.91 | 0.94 | (86) |

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

| | | | | | | | | | | | | | |
|--------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|------|
| (87)m= | 19.01 | 19.23 | 19.58 | 20.02 | 20.44 | 20.76 | 20.91 | 20.9 | 20.68 | 20.17 | 19.52 | 18.96 | (87) |
|--------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | | |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| (88)m= | 19.97 | 19.97 | 19.97 | 19.98 | 19.99 | 19.99 | 19.99 | 19.99 | 19.99 | 19.99 | 19.98 | 19.98 | (88) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|

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

| | | | | | | | | | | | | | |
|--------|------|-----|------|-----|------|------|-----|------|------|-----|------|------|------|
| (89)m= | 0.92 | 0.9 | 0.86 | 0.8 | 0.71 | 0.55 | 0.4 | 0.42 | 0.62 | 0.8 | 0.89 | 0.93 | (89) |
|--------|------|-----|------|-----|------|------|-----|------|------|-----|------|------|------|

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

| | | | | | | | | | | | | | |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|-------|-------|------|
| (90)m= | 17.34 | 17.66 | 18.16 | 18.79 | 19.36 | 19.78 | 19.93 | 19.92 | 19.68 | 19 | 18.08 | 17.28 | (90) |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|-------|-------|------|

$$fLA = \text{Living area} \div (4) =$$

| | |
|------|------|
| 0.17 | (91) |
|------|------|

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

| | | | | | | | | | | | | | |
|--------|-------|-------|-------|----|-------|-------|------|-------|-------|------|-------|-------|------|
| (92)m= | 17.63 | 17.94 | 18.41 | 19 | 19.55 | 19.95 | 20.1 | 20.09 | 19.86 | 19.2 | 18.33 | 17.57 | (92) |
|--------|-------|-------|-------|----|-------|-------|------|-------|-------|------|-------|-------|------|

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

| | | | | | | | | | | | | | |
|--------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|------|
| (93)m= | 17.48 | 17.79 | 18.26 | 18.85 | 19.4 | 19.8 | 19.95 | 19.94 | 19.71 | 19.05 | 18.18 | 17.42 | (93) |
|--------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|------|

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

| | | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|-----|------|------|-----|------|
| (94)m= | 0.89 | 0.86 | 0.83 | 0.77 | 0.68 | 0.54 | 0.39 | 0.42 | 0.6 | 0.76 | 0.86 | 0.9 | (94) |
|--------|------|------|------|------|------|------|------|------|-----|------|------|-----|------|

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

| | | | | | | | | | | | | | |
|--------|--------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| (95)m= | 547.41 | 580.3 | 581.1 | 548.98 | 480.49 | 364.55 | 253.97 | 265.14 | 378.03 | 470.43 | 507.77 | 528.97 | (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= | 1086.58 | 1059.85 | 964.93 | 809.09 | 624.36 | 418.06 | 269.71 | 284.3 | 452.3 | 685.79 | 902.55 | 1080.57 | (97) |
|--------|---------|---------|--------|--------|--------|--------|--------|-------|-------|--------|--------|---------|------|

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

| | | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|---|---|---|---|--------|--------|--------|------|
| (98)m= | 401.15 | 322.26 | 285.57 | 187.28 | 107.04 | 0 | 0 | 0 | 0 | 160.23 | 284.24 | 410.39 | (98) |
|--------|--------|--------|--------|--------|--------|---|---|---|---|--------|--------|--------|------|

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1, \dots, 5, 9, \dots, 12} =$$

| | |
|---------|------|
| 2158.15 | (98) |
|---------|------|

Space heating requirement in kWh/m²/year

| | |
|-------|------|
| 29.77 | (99) |
|-------|------|

SAP WorkSheet: New dwelling design stage

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 | $(204) = (202) \times [1 - (203)] =$ | 1 | (204) |
| Efficiency of main space heating system 1 | | 92.4 | (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)

| | | | | | | | | | | | |
|--------|--------|--------|--------|--------|---|---|---|---|--------|--------|--------|
| 401.15 | 322.26 | 285.57 | 187.28 | 107.04 | 0 | 0 | 0 | 0 | 160.23 | 284.24 | 410.39 |
|--------|--------|--------|--------|--------|---|---|---|---|--------|--------|--------|

$(211)_m = \{[(98)_m \times (204)]\} \times 100 \div (206)$ (211)

| | | | | | | | | | | | |
|--------|--------|--------|--------|--------|---|---|---|---|--------|--------|--------|
| 434.14 | 348.76 | 309.06 | 202.68 | 115.85 | 0 | 0 | 0 | 0 | 173.41 | 307.62 | 444.14 |
|--------|--------|--------|--------|--------|---|---|---|---|--------|--------|--------|

Total (kWh/year) = Sum(211)_{1...5,10...12} = 2335.66 (211)

Space heating fuel (secondary), kWh/month

$= \{[(98)_m \times (201)]\} \times 100 \div (208)$

(215)_m =

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

Total (kWh/year) = Sum(215)_{1...5,10...12} = 0 (215)

Water heating

Output from water heater (calculated above)

| | | | | | | | | | | | |
|--------|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|
| 170.92 | 150.2 | 156.7 | 139.04 | 135.22 | 119.33 | 113.2 | 126.17 | 126.56 | 144.26 | 154.34 | 166.33 |
|--------|-------|-------|--------|--------|--------|-------|--------|--------|--------|--------|--------|

Efficiency of water heater 87 (216)

(217)_m = 89.08 89.02 88.91 88.7 88.3 87 87 87 87 88.55 88.92 89.11 (217)

Fuel for water heating, kWh/month

$(219)_m = (64)_m \times 100 \div (217)_m$

(219)_m =

| | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 191.87 | 168.72 | 176.24 | 156.76 | 153.13 | 137.16 | 130.12 | 145.02 | 145.47 | 162.91 | 173.57 | 186.65 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

Total = Sum(219a)_{1...12} = 1927.62 (219)

Annual totals

| | | |
|--|-----------------|-----------------|
| | kWh/year | kWh/year |
| Space heating fuel used, main system 1 | | 2335.66 |
| Water heating fuel used | | 1927.62 |

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 357.25 (232)

Electricity generated by PVs -1281.68 (233)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 3413.84 (338)

10a. Fuel costs - individual heating systems:

| | Fuel kWh/year | Fuel Price (Table 12) | Fuel Cost £/year |
|-------------------------------|------------------|--------------------------|----------------------|
| Space heating - main system 1 | (211) x | 3.48 | x 0.01 = 81.28 (240) |
| Space heating - main system 2 | (213) x | 0 | x 0.01 = 0 (241) |

SAP WorkSheet: New dwelling design stage

| | | | | | |
|--|---------------------------------|-------|----------|---------|-------|
| Space heating - secondary | (215) x | 13.19 | x 0.01 = | 0 | (242) |
| Water heating cost (other fuel) | (219) | 3.48 | x 0.01 = | 67.08 | (247) |
| Pumps, fans and electric keep-hot | (231) | 13.19 | x 0.01 = | 9.89 | (249) |
| <small>(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a</small> | | | | | |
| Energy for lighting | (232) | 13.19 | x 0.01 = | 47.12 | (250) |
| Additional standing charges (Table 12) | | | | 120 | (251) |
| | one of (233) to (235) x | 13.19 | x 0.01 = | -169.05 | (252) |
| Appendix Q items: repeat lines (253) and (254) as needed | | | | | |
| Total energy cost | (245)...(247) + (250)...(254) = | | | 156.32 | (255) |

11a. SAP rating - individual heating systems

| | | | | | |
|---------------------------------|----------------------------------|------|--|-------|-------|
| Energy cost deflator (Table 12) | | 0.42 | | 0.42 | (256) |
| Energy cost factor (ECF) | [(255) x (256)] ÷ [(4) + 45.0] = | | | 0.56 | (257) |
| SAP rating (Section 12) | | | | 92.21 | (258) |

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

| | | Energy kWh/year | | Emission factor kg CO2/kWh | | Emissions kg CO2/year |
|---|---------------------------------|---------------------------|-------|--------------------------------------|---------|---------------------------------|
| Space heating (main system 1) | (211) x | | 0.216 | = | 504.5 | (261) |
| Space heating (secondary) | (215) x | | 0.519 | = | 0 | (263) |
| Water heating | (219) x | | 0.216 | = | 416.37 | (264) |
| Space and water heating | (261) + (262) + (263) + (264) = | | | | 920.87 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | | 0.519 | = | 38.93 | (267) |
| Electricity for lighting | (232) x | | 0.519 | = | 185.41 | (268) |
| Energy saving/generation technologies Item 1 | | | 0.519 | = | -665.19 | (269) |
| Total CO2, kg/year | | | | sum of (265)...(271) = | 480.01 | (272) |
| CO2 emissions per m² | | | | (272) ÷ (4) = | 6.62 | (273) |
| El rating (section 14) | | | | | 95 | (274) |

13a. Primary Energy

| | | Energy kWh/year | | Primary factor | | P. Energy kWh/year |
|---|---------------------------------|---------------------------|------|-----------------------|---------|------------------------------|
| Space heating (main system 1) | (211) x | | 1.22 | = | 2849.5 | (261) |
| Space heating (secondary) | (215) x | | 3.07 | = | 0 | (263) |
| Energy for water heating | (219) x | | 1.22 | = | 2351.7 | (264) |
| Space and water heating | (261) + (262) + (263) + (264) = | | | | 5201.2 | (265) |
| Electricity for pumps, fans and electric keep-hot | (231) x | | 3.07 | = | 230.25 | (267) |
| Electricity for lighting | (232) x | | 0 | = | 1096.75 | (268) |

SAP WorkSheet: New dwelling design stage

Energy saving/generation technologies

Item 1

3.07

=

-3934.77 (269)

'Total Primary Energy

sum of (265)...(271) =

2593.43 (272)

Primary energy kWh/m²/year

(272) ÷ (4) =

35.77 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 29 November 2022

Property Details: Plot 17

| | |
|---|---------------------------------------|
| Dwelling type: | Semi-detached House |
| Located in: | England |
| Region: | East Anglia |
| Cross ventilation possible: | Yes |
| Number of storeys: | 2 |
| Front of dwelling faces: | North |
| Overshading: | Average or unknown |
| Overhangs: | None |
| Thermal mass parameter: | Indicative Value Low |
| Night ventilation: | False |
| Blinds, curtains, shutters: | Dark-coloured curtain or roller blind |
| Ventilation rate during hot weather (ach): | 3 (Windows open half the time) |

Overheating Details:

| | | |
|--|--------|-------------|
| Summer ventilation heat loss coefficient: | 172.26 | (P1) |
| Transmission heat loss coefficient: | 49.2 | |
| Summer heat loss coefficient: | 221.48 | (P2) |

Overhangs:

| Orientation: | Ratio: | Z_overhangs: |
|---------------------|---------------|---------------------|
| North (W_1) | 0 | 1 |
| North (W_2) | 0 | 1 |
| East (W_3) | 0 | 1 |
| South (W_4) | 0 | 1 |
| East (W_5) | 0 | 1 |
| South (W_6) | 0 | 1 |
| South (W_7) | 0 | 1 |

Solar shading:

| Orientation: | Z blinds: | Solar access: | Overhangs: | Z summer: | |
|---------------------|------------------|----------------------|-------------------|------------------|-------------|
| North (W_1) | 0.85 | 0.9 | 1 | 0.76 | (P8) |
| North (W_2) | 0.85 | 0.9 | 1 | 0.76 | (P8) |
| East (W_3) | 0.85 | 0.9 | 1 | 0.76 | (P8) |
| South (W_4) | 0.85 | 0.9 | 1 | 0.76 | (P8) |
| East (W_5) | 0.85 | 0.9 | 1 | 0.76 | (P8) |
| South (W_6) | 0.85 | 0.9 | 1 | 0.76 | (P8) |
| South (W_7) | 0.85 | 0.9 | 1 | 0.76 | (P8) |

Solar gains:

| Orientation | Area | Flux | g_ | FF | Shading | Gains |
|--------------------|-------------|-------------|-----------|-----------|----------------|-----------------------|
| North (W_1) | 0.9 x | 1.17 | 82.12 | 0.63 | 0.7 | 29.17 |
| North (W_2) | 0.9 x | 1.12 | 82.12 | 0.63 | 0.7 | 27.93 |
| East (W_3) | 0.9 x | 0.39 | 119.47 | 0.63 | 0.7 | 14.15 |
| South (W_4) | 0.9 x | 2.98 | 114.84 | 0.63 | 0.7 | 103.91 |
| East (W_5) | 0.9 x | 0.39 | 119.47 | 0.63 | 0.7 | 14.15 |
| South (W_6) | 0.9 x | 1.14 | 114.84 | 0.63 | 0.7 | 39.75 |
| South (W_7) | 0.9 x | 1.25 | 114.84 | 0.63 | 0.7 | 43.59 |
| | | | | | Total | 272.64 (P3/P4) |

Internal gains:

| | June | July | August |
|--------------------|-------------|-------------|--------------------|
| Internal gains | 407.07 | 390.59 | 398.89 |
| Total summer gains | 692.57 | 663.23 | 651.71 (P5) |

SAP 2012 Overheating Assessment

| | | | | |
|--|------------------------|---------------|---------------|-------------|
| Summer gain/loss ratio | 3.13 | 2.99 | 2.94 | (P6) |
| Mean summer external temperature (East Anglia) | 15.4 | 17.6 | 17.6 | |
| Thermal mass temperature increment | 1.3 | 1.3 | 1.3 | |
| Threshold temperature | 19.83 | 21.89 | 21.84 | (P7) |
| Likelihood of high internal temperature | Not significant | Slight | Slight | |

Assessment of likelihood of high internal temperature: Slight