

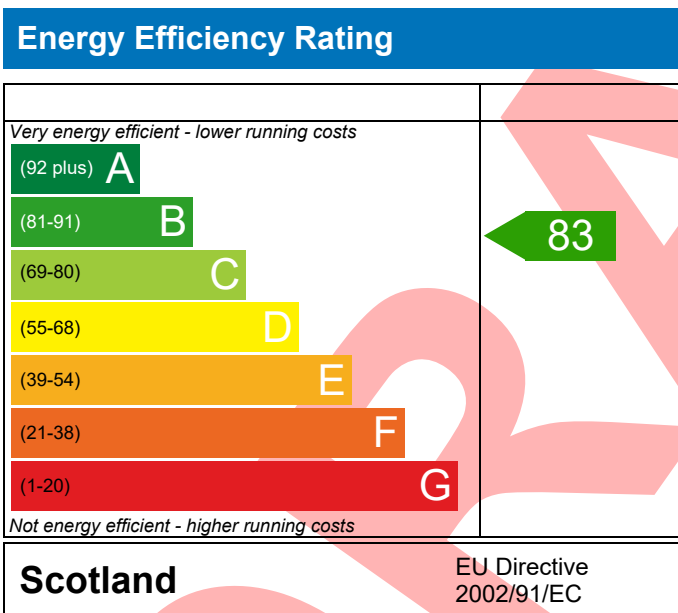
PREDICTED ENERGY ASSESSMENT

3SV -98, 73, Tarland Road,
Phase 4A (3),
Aboyne

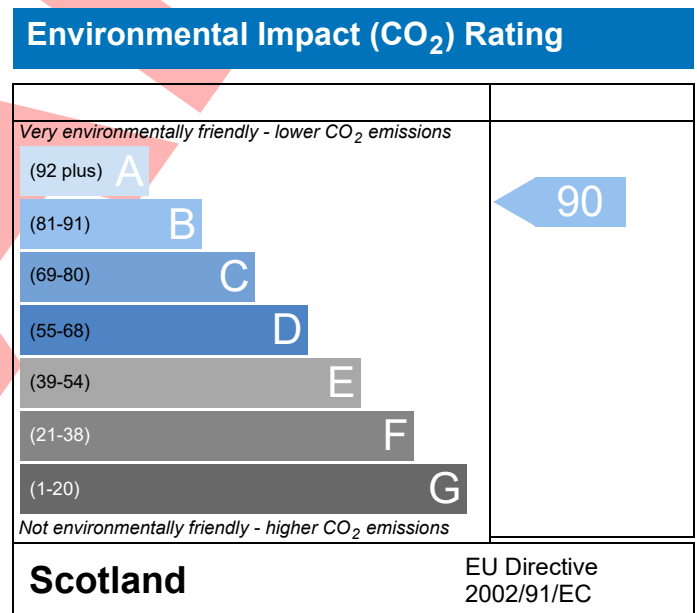
Dwelling type: House, Semi-Detached
Date of assessment: 31/01/2023
Produced by: Northern Energy
Total floor area: 98.2 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is 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.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

| | | | |
|----------------------|---|----------------|------------|
| Property Reference | ajc mortlich 73 | Issued on Date | 31/01/2023 |
| Assessment Reference | tar rd 73 | Prop Type Ref | |
| Property | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO ₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | Assessor ID | 1910-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|--|
| Client | |
|--------|--|

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

6.1 Carbon Dioxide Emissions

1a TER and DER

| | | | |
|---|----------------|-----------------------------------|------|
| Fuel for main heating | Bulk LPG | | |
| Fuel package for TER | LPG | | |
| Target Carbon Dioxide Emission Rate (TER) | 13.57 | kgCO ₂ /m ² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 11.99 | kgCO ₂ /m ² | Pass |
| | -1.58 (-11.6%) | kgCO ₂ /m ² | |

6.2 Building insulation envelope

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|------|
| External wall | 0.16 (max. 0.22) | 0.16 (max. 0.70) | Pass |
| Party wall | 0.00 (max. 0.20) | - | Pass |
| Floor | 0.12 (max. 0.18) | 0.12 (max. 0.70) | Pass |
| Roof | 0.10 (max. 0.15) | 0.10 (max. 0.35) | Pass |
| Openings | 1.40 (max. 1.60) | 1.40 (max. 3.30) | Pass |

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) |
|--------------------------------|---------------------|

6.3 Heating System

4 Heating efficiency

| | | |
|--------------------------|--|------|
| Main heating system | Boiler system with radiators or underfloor - Bulk LPG Data from database Baxi ASSURE 18 SYSTEM LPG Efficiency: 90.2% SEDBUK2009 Minimum: 88.0% | Pass |
| Secondary heating system | None | |

6 Controls

| | | |
|------------------------|-----------------------------------|------|
| Space heating controls | Time and temperature zone control | Pass |
| Hot water controls | Cylinderstat | Pass |
| | Independent timer for DHW | Pass |
| Boiler interlock | Yes | Pass |

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

6.4 Insulation of pipes, ducts and vessels

5 Cylinder insulation

| | | |
|----------------------------|---|------|
| Hot water storage | Measured cylinder loss: 2.22 kWh/day Permitted by DBSCG 2.56 | Pass |
| Primary pipework insulated | Yes | Pass |

6.5 Artificial and display lighting

7 Low energy lights

| | | | |
|---|-----|---|------|
| Percentage of fixed lights with low-energy fittings | 100 | % | |
| Minimum | 75 | % | Pass |

6.6 Mechanical ventilation and air conditioning

8 Mechanical ventilation

| | | | |
|---|---------------|--|------|
| Continuous extract system (decentralised) | | | |
| Specific fan power | 0.1700 0.1600 | | |
| Maximum | 0.7 | | Pass |

9 Summertime temperature

| | | |
|--|-----------------------------------|------|
| Overheating risk (North East Scotland) | Not significant | Pass |
| Based on: | | |
| Overshading | Average | |
| Windows facing North | 5.81 m ² , No overhang | |
| Windows facing East | 0.72 m ² , No overhang | |
| Windows facing South | 7.25 m ² , No overhang | |
| Air change rate | 2.50 ach | |
| Blinds/curtains | None | |

RECOMMENDATIONS

| | Typical cost | Typical savings per year | Energy efficiency | Environmental impact | Result |
|---------------------|------------------------|--------------------------|-------------------|----------------------|-------------------|
| Low energy lights | | | 0 | 0 | Already installed |
| Solar water heating | £4,000 - £6,000 | £71 | B 87 | A 93 | Recommended |
| Photovoltaic | | | 0 | 0 | Already installed |
| Wind turbine | | | 0 | 0 | Not applicable |
| Totals | £4,000 - £6,000 | £71 | B 87 | A 93 | |

DRAFT

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

THERMAL BRIDGING

Calculation Type: New Build (As Designed)

| | | | | | |
|------------------------------------|---|---------------|----------------|-------------|-----------|
| Property Reference | ajc mortlich 73 | | Issued on Date | 31/01/2023 | |
| Assessment Reference | tar rd 73 | Prop Type Ref | | | |
| Property | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | | | |
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO ₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | | | Assessor ID | 1910-0001 |
| Client | | | | | |

| | Junction detail | Source Type | Psi (W/mK) | Length (m) | Result | Reference |
|---------------|--|-------------------|------------|------------|--------|-----------|
| External wall | E2 Other lintels (including other steel lintels) | Scotland ACD 2015 | 0.037 | 11.05 | 0.41 | |
| External wall | E3 Sill | Scotland ACD 2015 | 0.033 | 8.55 | 0.28 | |
| External wall | E4 Jamb | Scotland ACD 2015 | 0.031 | 25.50 | 0.79 | |
| External wall | E5 Ground floor (normal) | Scotland ACD 2015 | 0.097 | 20.57 | 2.00 | |
| External wall | E6 Intermediate floor within a dwelling | Scotland ACD 2015 | 0.065 | 20.57 | 1.34 | |
| External wall | E10 Eaves (insulation at ceiling level) | Scotland ACD 2015 | 0.043 | 9.57 | 0.41 | |
| External wall | E12 Gable (insulation at ceiling level) | Scotland ACD 2015 | 0.051 | 11.00 | 0.56 | |
| External wall | E16 Corner (normal) | Scotland ACD 2015 | 0.038 | 14.52 | 0.55 | |
| External wall | E17 Corner (inverted – internal area greater than external area) | Scotland ACD 2015 | -0.029 | 4.84 | -0.14 | |
| External wall | E18 Party wall between dwellings | Scotland ACD 2015 | 0.086 | 9.00 | 0.77 | |
| Party wall | P1 Party wall - Ground floor | Scotland ACD 2015 | 0.099 | 9.00 | 0.89 | |
| Party wall | P4 Party wall - Roof (insulation at ceiling level) | Scotland ACD 2015 | 0.090 | 9.00 | 0.81 | |

Total: **8.67** W/mK:
 Y-Value: **0.043** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

| | | | | | |
|--|---|-----------------------|-------|-----------------------|------------|
| Property Reference | ajc mortlich 73 | | | Issued on Date | 31/01/2023 |
| Assessment Reference | tar rd 73 | Prop Type Ref | | | |
| Property | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | | | |
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | | | Assessor ID | 1910-0001 |
| Client | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Domestic Handbook Section 6, 2015 Edition

REGULATIONS COMPLIANCE REPORT - Domestic Handbook Section 6, 2015 Edition

Semi-Detached House, total floor area 98 m²

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

1 TER and DER

Fuel for main heating: Bulk LPG
Fuel package for TER: LPG
Target Carbon Dioxide Emission Rate (TER) 13.57 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.99 kgCO₂/m² OK

2 Fabric U-values

| Element | Average | Highest | |
|---------------|------------------|------------------|----|
| External wall | 0.16 (max. 0.22) | 0.16 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.12 (max. 0.18) | 0.12 (max. 0.70) | OK |
| Roof | 0.10 (max. 0.15) | 0.10 (max. 0.35) | OK |
| Openings | 1.40 (max. 1.60) | 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)

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Bulk LPG
Data from database
Baxi ASSURE 18 SYSTEM LPG

Efficiency: 90.2% SEDBUK2009
Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.22 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control 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%
Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1600
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (North East Scotland): Not significant OK

Based on:

Overshading: Average
Windows facing North: 5.81 m², No overhang
Windows facing East: 0.72 m², No overhang
Windows facing South: 7.25 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Photovoltaic array 1.01 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-----------------------------|----------------|-------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.2500 (18) |
| Number of sides sheltered | | | | | 3 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.1938 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22) |
| Wind factor | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.2470 | 0.2422 | 0.2373 | 0.2131 | 0.2083 | 0.1841 | 0.1841 | 0.1792 | 0.1938 | 0.2083 | 0.2180 | 0.2277 (22b) |
| Mechanical extract ventilation - decentralised | | | | | | | | | | | | |
| If mechanical ventilation: | | | | | | | | | | | | 0.5000 (23a) |
| Effective ac | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|---------------|----------------------|----------------|---------------|
| Entrance Door | | | 2.1000 | 1.4000 | 2.9400 | | (26) |
| Windows/ Patios (Uw = 1.40) | | | 13.7800 | 1.3258 | 18.2689 | | (27) |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1200 | 5.8920 | | (28a) |
| Render/ Blk T/Frame | 96.5000 | 12.7000 | 83.8000 | 0.1600 | 13.4080 | | (29a) |
| Feature Stone | 8.4100 | 3.1800 | 5.2300 | 0.1600 | 0.8368 | | (29a) |
| Horizontal | 49.1000 | | 49.1000 | 0.1000 | 4.9100 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 203.1100 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 46.2557 | (33) |
| Party Wall 1 | | | 45.9000 | 0.0000 | 0.0000 | | (32) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6728 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 54.9285 (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 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 (38) |
| Heat transfer coeff | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 96.2461 (39) |
| HLP | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 (40) |
| HLP (average) | | | | | | | | | | | | 0.9801 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---|
| Water storage loss: | 25.4614 | 22.2687 | 22.9793 | 20.0339 | 19.2230 | 16.5880 | 15.3712 | 17.6387 | 17.8494 | 20.8017 | 22.7067 | 24.6580 (46) |
| Store volume | | | | | | | | | | | | 250.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 2.2200 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.1988 (55) |
| Total storage loss | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (56) |
| If cylinder contains dedicated solar storage | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | 230.1679 | 203.0356 | 213.6206 | 192.0355 | 188.5787 | 169.0627 | 162.9000 | 178.0166 | 177.4718 | 199.1033 | 209.8540 | 224.8119 (62) |
| Solar input | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (63) |
| FGHRS | -31.7083 | -27.6241 | -28.0811 | -24.3859 | -19.1518 | -10.4266 | -10.0486 | -10.9782 | -10.9438 | -24.9443 | -27.8943 | -31.2025 eq.(G6) |
| Output from w/h | 198.4596 | 175.4116 | 185.5395 | 167.6496 | 169.4269 | 158.6361 | 152.8515 | 167.0383 | 166.5280 | 174.1590 | 181.9597 | 193.6095 (64) |
| Heat gains from water heating, kWh/month | 104.7796 | 93.0244 | 99.2776 | 91.1893 | 90.9512 | 83.5509 | 82.4130 | 87.4393 | 86.3469 | 94.4506 | 97.1140 | 102.9987 (65) |
| | | | | | | | | | | | | Total per year (kWh/year) = Sum(64)m = 2091.2694 (64) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| (66)m | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 24.2220 | 21.5138 | 17.4962 | 13.2457 | 9.9014 | 8.3591 | 9.0323 | 11.7406 | 15.7582 | 20.0086 | 23.3530 | 24.8952 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 253.3845 | 256.0139 | 249.3880 | 235.2824 | 217.4765 | 200.7415 | 189.5616 | 186.9322 | 193.5581 | 207.6637 | 225.4696 | 242.2045 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 (71) |
| Water heating gains (Table 5) | 140.8328 | 138.4291 | 133.4377 | 126.6518 | 122.2462 | 116.0429 | 110.7702 | 117.5259 | 119.9263 | 126.9498 | 134.8805 | 138.4392 (72) |
| Total internal gains | 485.2728 | 482.7902 | 467.1553 | 442.0134 | 416.4575 | 391.9770 | 376.1975 | 383.0321 | 396.0759 | 421.4555 | 450.5365 | 472.3723 (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | g | Specific data or Table 6c | FF | Access factor Table 6d | Gains W | | | | |
|-------------|----------|--------------------------|---------------------------|----------|---------------------------|----------|------------------------|----------|----------|----------|----------|---------------|
| North | 5.8100 | 10.6334 | 0.6300 | 0.6300 | 0.7000 | 0.7700 | 18.8808 (74) | | | | | |
| East | 0.7200 | 19.6403 | 0.6300 | 0.6300 | 0.7000 | 0.7700 | 4.3217 (76) | | | | | |
| South | 7.2500 | 46.7521 | 0.6300 | 0.6300 | 0.7000 | 0.7700 | 103.5883 (78) | | | | | |
| Solar gains | 126.7907 | 214.1871 | 291.3402 | 363.0345 | 412.0704 | 412.4374 | 396.1706 | 358.4453 | 315.6574 | 235.9670 | 151.4679 | 108.8037 (83) |
| Total gains | 612.0635 | 696.9773 | 758.4955 | 805.0479 | 828.5279 | 804.4143 | 772.3681 | 741.4774 | 711.7332 | 657.4225 | 602.0044 | 581.1760 (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 (85) |
| tau | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 |
| alpha | 0.9610 | 0.9427 | 0.9135 | 0.8606 | 0.7709 | 0.6373 | 0.5000 | 0.5344 | 0.7166 | 0.8735 | 0.9427 | 0.9661 (86) |
| util living area | 19.0300 | 19.2747 | 19.6417 | 20.0881 | 20.5043 | 20.8003 | 20.9279 | 20.9102 | 20.7022 | 20.1751 | 19.5109 | 18.9596 (87) |
| MIT | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 (88) |
| Th 2 | 0.9556 | 0.9349 | 0.9013 | 0.8395 | 0.7337 | 0.5745 | 0.4128 | 0.4484 | 0.6610 | 0.8501 | 0.9335 | 0.9613 (89) |
| util rest of house | 17.4504 | 17.8028 | 18.3294 | 18.9615 | 19.5321 | 19.9096 | 20.0490 | 20.0331 | 19.7970 | 19.0936 | 18.1485 | 17.3489 (90) |
| Living area fraction | 17.7269 | 18.0605 | 18.5591 | 19.1587 | 19.7023 | 20.0655 | 20.2029 | 20.1867 | 19.9555 | 19.2829 | 18.3870 | 17.6309 (92) |
| MIT 2 | 17.5769 | 17.9105 | 18.4091 | 19.0087 | 19.5523 | 19.9155 | 20.0529 | 20.0367 | 19.8055 | 19.1329 | 18.2370 | 17.4809 (93) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 |
| adjusted MIT | | | | | | | | | | | | 17.4809 (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|
| Useful gains | 0.9341 | 0.9091 | 0.8716 | 0.8085 | 0.7078 | 0.5604 | 0.4080 | 0.4419 | 0.6404 | 0.8189 | 0.9074 | 0.9413 (94) |
| Ext temp. | 571.7479 | 633.6354 | 661.1330 | 650.8888 | 586.4557 | 450.7721 | 315.1230 | 327.6914 | 455.8024 | 538.3610 | 546.2635 | 547.0852 (95) |
| Heat loss rate W | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 (96) |
| Month fracti | 1277.8546 | 1252.2068 | 1146.2062 | 972.9223 | 755.7529 | 511.5983 | 332.3258 | 350.0156 | 549.1283 | 821.2586 | 1071.8903 | 1278.2347 (97) |
| Space heating kWh | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 (97a) |
| Space heating per m2 | 525.3434 | 415.6800 | 360.8945 | 231.8641 | 125.9572 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 210.4758 | 378.4513 | 543.9752 (98) |
| | | | | | | | | | | | | 2792.6414 (98) |
| | | | | | | | | | | | | (98) / (4) = 28.4383 (99) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 91.2000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | 525.3434 | 415.6800 | 360.8945 | 231.8641 | 125.9572 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 210.4758 | 378.4513 | 543.9752 | (98) |
| Space heating efficiency (main heating system 1) | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 91.2000 | 91.2000 | 91.2000 | (210) |
| Space heating fuel (main heating system) | 576.0344 | 455.7895 | 395.7176 | 254.2370 | 138.1109 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 230.7848 | 414.9686 | 596.4641 | (211) |
| Water heating requirement | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (215) |
| Water heating requirement | 198.4596 | 175.4116 | 185.5395 | 167.6496 | 169.4269 | 158.6361 | 152.8515 | 167.0383 | 166.5280 | 174.1590 | 181.9597 | 193.6095 | (64) |
| Efficiency of water heater (217)m | 87.9931 | 87.7391 | 87.2617 | 86.3818 | 84.7395 | 80.5000 | 80.5000 | 80.5000 | 80.5000 | 86.0228 | 87.4269 | 88.1253 | (217) |
| Fuel for water heating, kWh/month | 225.5400 | 199.9240 | 212.6242 | 194.0797 | 199.9386 | 197.0635 | 189.8776 | 207.5011 | 206.8671 | 202.4569 | 208.1279 | 219.6980 | (219) |
| Water heating fuel used | | | | | | | | | | | | | (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 3062.1068 (211) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 (215) |
| Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 8.7725, total flow = 37.0000, SFP = 0.2371) | | | | | | | | | | | | | |
| mechanical ventilation fans (SFP = 0.2371) | | | | | | | | | | | | | 72.4324 (230a) |
| central heating pump | | | | | | | | | | | | | 30.0000 (230c) |
| main heating flue fan | | | | | | | | | | | | | 45.0000 (230e) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 147.4324 (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 427.7687 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 1.01 * 1080 * 1.00) = | | | | | | | | | | -872.2559 | | | -872.2559 (233) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5228.7507 (238) |

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|-----------------|----------------------------|-----------------------|-------|
| Space heating - main system 1 | 3062.1068 | 0.2410 | 737.9677 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 2463.6986 | 0.2410 | 593.7514 | (264) |
| Space and water heating | | | 1331.7191 | (265) |
| Pumps and fans | 147.4324 | 0.5190 | 76.5174 | (267) |
| Energy for lighting | 427.7687 | 0.5190 | 222.0120 | (268) |
| Energy saving/generation technologies | | | | |
| PV Unit | -872.2559 | 0.5190 | -452.7008 | (269) |
| Total CO2, kg/year | | | 1177.5477 | (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) | | | 11.9900 | (273) |

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

| | | | |
|---|--|---------|-----|
| DER | | 11.9900 | ZC1 |
| Total Floor Area | | 98.2000 | TFA |
| Assumed number of occupants | | 2.7222 | N |
| CO2 emission factor in Table 12 for electricity displaced from grid | | 0.5190 | EF |
| CO2 emissions from appliances, equation (L14) | | 15.2903 | ZC2 |
| CO2 emissions from cooking, equation (L16) | | 1.8771 | ZC3 |
| Total CO2 emissions | | 29.1574 | ZC4 |
| Residual CO2 emissions offset from biofuel CHP | | 0.0000 | ZC5 |
| Additional allowable electricity generation, kWh/m ² /year | | 0.0000 | ZC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation | | 0.0000 | ZC7 |
| Net CO2 emissions | | 29.1574 | ZC8 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour |
|---|--------------|-------------------|-------|-----------------------------|-------------------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 1 | 0 | 0 | 1 * 20 = | 20.0000 (6b) |
| Number of intermittent fans | | | | 4 * 10 = | 40.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 60.0000 / (5) = | 0.2396 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 7.0000 |
| Infiltration rate | | | | | 0.5896 (18) |
| Number of sides sheltered | | | | | 2 (19) |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.5012 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22) |
| Wind factor | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.6390 | 0.6265 | 0.6139 | 0.5513 | 0.5388 | 0.4761 | 0.4761 | 0.4636 | 0.5012 | 0.5388 | 0.5638 | 0.5889 (22b) |
| Effective ac | 0.7042 | 0.6962 | 0.6885 | 0.6520 | 0.6451 | 0.6133 | 0.6133 | 0.6075 | 0.6256 | 0.6451 | 0.6589 | 0.6734 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K | | | | | |
|---|----------------------|-------------------------|------------------------|----------------------------|------------------------------|-----------------------------|----------------------------|----------|----------|----------|----------|---------------|
| TER Opaque door | | | 1.8500 | 1.4000 | 2.5900 | | (26) | | | | | |
| TER Opening Type (Uw = 1.40) | | | 22.7000 | 1.3258 | 30.0947 | | (27) | | | | | |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1500 | 7.3650 | | (28a) | | | | | |
| Render/ Blk T/Frame | 104.9100 | 24.5500 | 80.3600 | 0.1700 | 13.6612 | | (29a) | | | | | |
| Horizontal | 49.1000 | | 49.1000 | 0.1100 | 5.4010 | | (30) | | | | | |
| Total net area of external elements Aum(A, m ²) | | | 203.1100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 59.1119 | | (33) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 100.0000 (35) | | | | | |
| Thermal bridges (User defined value 0.080 * total exposed area) | | | | | | | 16.2488 (36) | | | | | |
| Total fabric heat loss | | | | | | | (33) + (36) = 75.3607 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | 58.1878 | 57.5327 | 56.8906 | 53.8746 | 53.3103 | 50.6835 | 50.6835 | 50.1970 | 51.6953 | 53.3103 | 54.4519 | 55.6453 (38) |
| Heat transfer coeff | 133.5485 | 132.8934 | 132.2513 | 129.2353 | 128.6710 | 126.0442 | 126.0442 | 125.5577 | 127.0560 | 128.6710 | 129.8126 | 131.0060 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 129.2326 (39) |
| HLP | 1.3600 | 1.3533 | 1.3468 | 1.3160 | 1.3103 | 1.2835 | 1.2835 | 1.2786 | 1.2938 | 1.3103 | 1.3219 | 1.3341 (40) |
| HLP (average) | | | | | | | | | | | | 1.3160 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| 25.4614 | 22.2687 | 22.9793 | 20.0339 | 19.2230 | 16.5880 | 15.3712 | 17.6387 | 17.8494 | 20.8017 | 22.7067 | 24.6580 (46) | |
| Water storage loss: | | | | | | | | | | | | 150.0000 (47) |
| Store volume | | | | | | | | | | | | 1.8900 (48) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 0.5400 (49) |
| Temperature factor from Table 2b | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.0206 (55) |
| Total storage loss | | | | | | | | | | | | |
| | 31.6386 | 28.5768 | 31.6386 | 30.6180 | 31.6386 | 30.6180 | 31.6386 | 31.6386 | 30.6180 | 31.6386 | 30.6180 | 31.6386 (56) |
| If cylinder contains dedicated solar storage | | | | | | | | | | | | |
| | 31.6386 | 28.5768 | 31.6386 | 30.6180 | 31.6386 | 30.6180 | 31.6386 | 31.6386 | 30.6180 | 31.6386 | 30.6180 | 31.6386 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | | | | | | | | | | | | |
| | 224.6437 | 198.0460 | 208.0964 | 186.6895 | 183.0545 | 163.7167 | 157.3758 | 172.4924 | 172.1258 | 193.5791 | 204.5080 | 219.2877 (62) |
| WWHRS | -41.0252 | -36.0948 | -36.8406 | -30.3259 | -28.1658 | -23.2407 | -19.6790 | -23.8235 | -24.5141 | -30.2939 | -35.0771 | -39.6495 eq. (G10) |
| Total of WWHRS savings | | | | | | | | | | | | -368.7301 |
| Solar input | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (63) |
| Output from w/h | | | | | | | | | | | | |
| | 183.6184 | 161.9512 | 171.2558 | 156.3635 | 154.8887 | 140.4760 | 137.6968 | 148.6689 | 147.6117 | 163.2852 | 169.4310 | 179.6382 (64) |
| Heat gains from water heating, kWh/month | | | | | | | | | | | | |
| | 100.3602 | 89.0327 | 94.8583 | 86.9125 | 86.5318 | 79.2741 | 77.9937 | 83.0199 | 82.0701 | 90.0313 | 92.8372 | 98.5794 (65) |

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

| | | | | | | | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| (66)m | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | |
| | 22.5894 | 20.0637 | 16.3169 | 12.3530 | 9.2340 | 7.7957 | 8.4235 | 10.9492 | 14.6960 | 18.6600 | 21.7790 | 23.2172 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | |
| | 253.3845 | 256.0139 | 249.3880 | 235.2824 | 217.4765 | 200.7415 | 189.5616 | 186.9322 | 193.5581 | 207.6637 | 225.4696 | 242.2045 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | |
| | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | |
| | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | |
| | 134.8928 | 132.4891 | 127.4977 | 120.7118 | 116.3062 | 110.1029 | 104.8302 | 111.5859 | 113.9863 | 121.0098 | 128.9405 | 132.4992 (72) |
| Total internal gains | 477.7001 | 475.4001 | 460.0360 | 435.1806 | 409.8501 | 385.4735 | 369.6487 | 376.3008 | 389.0738 | 414.1669 | 443.0225 | 464.7544 (73) |

6. Solar gains

| | | | | | | | | | | | | |
|-------------|----------------|------------------|----------|---------------|-----------|---------------|-----------|-----------|----------|---------------|----------|---------------|
| [Jan] | | | | | | | | | | | | |
| | Area | Solar flux | | g | | FF | | Access | | Gains | | |
| | m ² | Table 6a | | Specific data | | Specific data | | factor | | W | | |
| | | W/m ² | | or Table 6b | | or Table 6c | | Table 6d | | | | |
| East | 22.7000 | 19.6403 | | 0.6300 | | 0.7000 | | 0.7700 | | 136.2527 (76) | | |
| Solar gains | 136.2527 | 266.5391 | 438.9520 | 640.1853 | 784.5711 | 803.1481 | 764.6297 | 656.8056 | 510.5193 | 316.2711 | 169.8911 | 112.0476 (83) |
| Total gains | 613.9528 | 741.9392 | 898.9880 | 1075.3658 | 1194.4212 | 1188.6216 | 1134.2784 | 1033.1064 | 899.5930 | 730.4380 | 612.9135 | 576.8019 (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| tau | 20.4254 | 20.5261 | 20.6257 | 21.1071 | 21.1996 | 21.6414 | 21.6414 | 21.7253 | 21.4691 | 21.1996 | 21.0132 | 20.8218 |
| alpha | 2.3617 | 2.3684 | 2.3750 | 2.4071 | 2.4133 | 2.4428 | 2.4428 | 2.4484 | 2.4313 | 2.4133 | 2.4009 | 2.3881 |
| util living area | 0.9651 | 0.9453 | 0.9047 | 0.8241 | 0.7077 | 0.5638 | 0.4414 | 0.4905 | 0.6994 | 0.8794 | 0.9493 | 0.9695 (86) |
| MIT | 18.2225 | 18.5556 | 19.1192 | 19.8343 | 20.3944 | 20.7626 | 20.9062 | 20.8766 | 20.5710 | 19.8006 | 18.9008 | 18.1923 (87) |
| Th 2 | 19.7942 | 19.7993 | 19.8044 | 19.8283 | 19.8328 | 19.8537 | 19.8537 | 19.8576 | 19.8457 | 19.8328 | 19.8237 | 19.8142 (88) |
| util rest of house | 0.9594 | 0.9365 | 0.8893 | 0.7954 | 0.6590 | 0.4889 | 0.3417 | 0.3895 | 0.6316 | 0.8530 | 0.9397 | 0.9646 (89) |
| MIT 2 | 16.1175 | 16.6001 | 17.4094 | 18.4248 | 19.1781 | 19.6473 | 19.7965 | 19.7767 | 19.4348 | 18.4066 | 17.1184 | 16.0840 (90) |
| Living area fraction | | | | | | | | | | | | 0.1751 (91) |
| MIT | 16.4859 | 16.9424 | 17.7087 | 18.6715 | 19.3910 | 19.8425 | 19.9907 | 19.9692 | 19.6337 | 18.6506 | 17.4304 | 16.4530 (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 |
| adjusted MIT | 16.3359 | 16.7924 | 17.5587 | 18.5215 | 19.2410 | 19.6925 | 19.8407 | 19.8192 | 19.4837 | 18.5006 | 17.2804 | 16.3030 (93) |

8. Space heating requirement

| | | | | | | | | | | | | |
|----------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------|-----------|---------------------------|
| Utilisation | 0.9337 | 0.9040 | 0.8496 | 0.7558 | 0.6307 | 0.4774 | 0.3405 | 0.3858 | 0.6068 | 0.8126 | 0.9085 | 0.9412 (94) |
| Useful gains | 573.2678 | 670.7018 | 763.7793 | 812.8113 | 753.2623 | 567.4083 | 386.2473 | 398.5977 | 545.8411 | 593.5509 | 556.8511 | 542.9000 (95) |
| Ext temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 (96) |
| Heat loss rate W | | | | | | | | | | | | |
| | 1607.3821 | 1580.4220 | 1462.5254 | 1243.4402 | 970.3078 | 641.8804 | 408.4734 | 429.3113 | 684.0339 | 1016.5781 | 1321.5463 | 1585.5718 (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 (97a) |
| Space heating kWh | | | | | | | | | | | | |
| | 769.3811 | 611.3320 | 519.8671 | 310.0528 | 161.4819 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 314.7323 | 550.5806 | 775.7478 (98) |
| Space heating | | | | | | | | | | | | 4013.1756 (98) |
| Space heating per m ² | | | | | | | | | | | | (98) / (4) = 40.8674 (99) |

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.1000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 0.9000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 92.0000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 60.0000 (208) |
| Space heating requirement | 769.3811 | 611.3320 | 519.8671 | 310.0528 | 161.4819 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 314.7323 | 550.5806 | 775.7478 | (98) |
| Space heating efficiency (main heating system 1) | 92.0000 | 92.0000 | 92.0000 | 92.0000 | 92.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 92.0000 | 92.0000 | 92.0000 | (210) |
| Space heating fuel (main heating system) | 752.6554 | 598.0421 | 508.5656 | 303.3126 | 157.9714 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 307.8903 | 538.6114 | 758.8838 | (211) |
| Water heating requirement | 128.2302 | 101.8887 | 86.6445 | 51.6755 | 26.9137 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 52.4554 | 91.7634 | 129.2913 | (215) |
| Water heating requirement | 183.6184 | 161.9512 | 171.2558 | 156.3635 | 154.8887 | 140.4760 | 137.6968 | 148.6689 | 147.6117 | 163.2852 | 169.4310 | 179.6382 | (64) |
| Efficiency of water heater (217)m | 87.8980 | 87.6837 | 87.2000 | 86.1314 | 84.3535 | 79.3000 | 79.3000 | 79.3000 | 79.3000 | 86.0557 | 87.3563 | 87.9578 | (216) |
| Fuel for water heating, kWh/month | 208.8994 | 184.6993 | 196.3942 | 181.5407 | 183.6185 | 177.1450 | 173.6404 | 187.4766 | 186.1433 | 189.7437 | 193.9539 | 204.2324 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2267.4875 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 3925.9326 (211) |
| Space heating fuel - secondary | | | | | | | | | | | | | 668.8626 (215) |
| Electricity for pumps and fans: | | | | | | | | | | | | | |
| central heating pump | | | | | | | | | | | | | 30.0000 (230c) |
| main heating flue fan | | | | | | | | | | | | | 45.0000 (230e) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 75.0000 (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 398.9361 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 0.98 * 1029 * 1.00) = | | | | | | | | | | | | | -806.8824 |
| Total delivered energy for all uses | | | | | | | | | | | | | 6529.3365 (238) |

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|--|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1 | 3925.9326 | 0.2410 | 946.1498 (261) |
| Space heating - secondary | 668.8626 | 0.0190 | 12.7084 (263) |
| Water heating (other fuel) | 2267.4875 | 0.2410 | 546.4645 (264) |
| Space and water heating | | | 1505.3226 (265) |
| Pumps and fans | 75.0000 | 0.5190 | 38.9250 (267) |
| Energy for lighting | 398.9361 | 0.5190 | 207.0479 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -806.8824 | 0.5190 | -418.7720 (269) |
| Total CO2, kg/m2/year | | | 1332.5235 (272) |
| Target Carbon Dioxide Emission Rate (TER) = 1332.5235 / 98.20, rounded to 2 d.p. | | | 13.5700 (273) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-----------------------------|-----------------|--------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 3 * 10 = | 30.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 30.0000 / (5) = | 0.1198 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | 5.0000 | |
| Infiltration rate | | | | 0.3698 (18) | |
| Number of sides sheltered | | | | 3 (19) | |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.2866 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22) |
| Wind factor | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.3654 | 0.3582 | 0.3511 | 0.3153 | 0.3081 | 0.2723 | 0.2723 | 0.2651 | 0.2866 | 0.3081 | 0.3224 | 0.3368 (22b) |
| Effective ac | 0.5668 | 0.5642 | 0.5616 | 0.5497 | 0.5475 | 0.5371 | 0.5371 | 0.5351 | 0.5411 | 0.5475 | 0.5520 | 0.5567 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|---------------|----------------------|----------------|---------------|
| Entrance Door | | | 2.1000 | 1.4000 | 2.9400 | | (26) |
| Windows/ Patios (Uw = 1.40) | | | 13.7800 | 1.3258 | 18.2689 | | (27) |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1200 | 5.8920 | | (28a) |
| Render/ Blk T/Frame | 96.5000 | 12.7000 | 83.8000 | 0.1600 | 13.4080 | | (29a) |
| Feature Stone | 8.4100 | 3.1800 | 5.2300 | 0.1600 | 0.8368 | | (29a) |
| Horizontal | 49.1000 | | 49.1000 | 0.1000 | 4.9100 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 203.1100 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 46.2557 | (33) |
| Party Wall 1 | | | 45.9000 | 0.0000 | 0.0000 | | (32) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6728 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 54.9285 (37) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|---------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | 46.8346 | 46.6204 | 46.4104 | 45.4241 | 45.2396 | 44.3805 | 44.3805 | 44.2214 | 44.7114 | 45.2396 | 45.6129 | 46.0032 (38) |
| Heat transfer coeff | 101.7631 | 101.5489 | 101.3389 | 100.3526 | 100.1681 | 99.3090 | 99.3090 | 99.1499 | 99.6399 | 100.1681 | 100.5414 | 100.9316 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 100.3517 (39) |
| HLP | 1.0363 | 1.0341 | 1.0320 | 1.0219 | 1.0200 | 1.0113 | 1.0113 | 1.0097 | 1.0147 | 1.0200 | 1.0238 | 1.0278 (40) |
| HLP (average) | | | | | | | | | | | | 1.0219 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (46) |
| Water storage loss: | | | | | | | | | | | | |
| Total storage loss | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| If cylinder contains dedicated solar storage | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (56) | |
| Primary loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (57) |
| Heat gains from water heating, kWh/month | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (59) |
| | 36.0703 | 31.5473 | 32.5540 | 28.3814 | 27.2326 | 23.4997 | 21.7759 | 24.9882 | 25.2866 | 29.4691 | 32.1678 | 34.9322 | | | | | | | | | | | | | (65) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------|
| (66)m | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | 136.1113 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 24.2220 | 21.5138 | 17.4962 | 13.2457 | 9.9014 | 8.3591 | 9.0323 | 11.7406 | 15.7582 | 20.0086 | 23.3530 | 24.8952 | (67) | |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 253.3845 | 256.0139 | 249.3880 | 235.2824 | 217.4765 | 200.7415 | 189.5616 | 186.9322 | 193.5581 | 207.6637 | 225.4696 | 242.2045 | (68) | |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | 36.6111 | (69) | |
| Pumps, fans | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (70) | |
| Losses e.g. evaporation (negative values) (Table 5) | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | (71) | |
| Water heating gains (Table 5) | 48.4816 | 46.9454 | 43.7554 | 39.4186 | 36.6030 | 32.6384 | 29.2687 | 33.5862 | 35.1203 | 39.6090 | 44.6775 | 46.9519 | (72) | |
| Total internal gains | 389.9216 | 388.3065 | 374.4730 | 351.7801 | 327.8143 | 305.5725 | 291.6960 | 296.0924 | 308.2699 | 331.1147 | 357.3335 | 377.8850 | (73) | |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | g | FF Specific data or Table 6c | Access factor Table 6d | Gains W | | | | | | |
|-------------|------------|--------------------------------|------------------------------|----------|------------------------------------|------------------------------|------------|----------|----------|----------|----------|----------|------|
| North | 5.8100 | 10.6334 | 0.6300 | | 0.7000 | 0.7700 | 18.8808 | (74) | | | | | |
| East | 0.7200 | 19.6403 | 0.6300 | | 0.7000 | 0.7700 | 4.3217 | (76) | | | | | |
| South | 7.2500 | 46.7521 | 0.6300 | | 0.7000 | 0.7700 | 103.5883 | (78) | | | | | |
| Solar gains | 126.7907 | 214.1871 | 291.3402 | 363.0345 | 412.0704 | 412.4374 | 396.1706 | 358.4453 | 315.6574 | 235.9670 | 151.4679 | 108.8037 | (83) |
| Total gains | 516.7123 | 602.4936 | 665.8132 | 714.8147 | 739.8846 | 718.0099 | 687.8665 | 654.5377 | 623.9273 | 567.0817 | 508.8014 | 486.6887 | (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Thl (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|---------|------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | | | | | | | | | | | | | 21.0000 | (85) |
| tau | 26.8052 | 26.8617 | 26.9174 | 27.1819 | 27.2320 | 27.4676 | 27.4676 | 27.5116 | 27.3764 | 27.2320 | 27.1309 | 27.0260 | | |
| alpha | 2.7870 | 2.7908 | 2.7945 | 2.8121 | 2.8155 | 2.8312 | 2.8312 | 2.8341 | 2.8251 | 2.8155 | 2.8087 | 2.8017 | | |
| util living area | 0.9745 | 0.9602 | 0.9370 | 0.8931 | 0.8161 | 0.6924 | 0.5574 | 0.5956 | 0.7733 | 0.9088 | 0.9620 | 0.9782 | (86) | |
| MIT | 18.7350 | 18.9976 | 19.3961 | 19.9037 | 20.3756 | 20.7355 | 20.8977 | 20.8733 | 20.6086 | 19.9972 | 19.2724 | 18.6831 | (87) | |
| Th 2 | 20.0532 | 20.0550 | 20.0568 | 20.0651 | 20.0667 | 20.0739 | 20.0739 | 20.0753 | 20.0711 | 20.0667 | 20.0635 | 20.0602 | (88) | |
| util rest of house | 0.9707 | 0.9543 | 0.9273 | 0.8752 | 0.7820 | 0.6295 | 0.4634 | 0.5042 | 0.7208 | 0.8900 | 0.9553 | 0.9750 | (89) | |
| MIT 2 | 17.9670 | 18.2277 | 18.6219 | 19.1231 | 19.5723 | 19.8989 | 20.0238 | 20.0096 | 19.7939 | 19.2217 | 18.5086 | 17.9205 | (90) | |
| Living area fraction | | | | | | | | | | FLA = Living area / (4) = | | 0.1751 | (91) | |
| MIT | 18.1014 | 18.3625 | 18.7574 | 19.2597 | 19.7129 | 20.0453 | 20.1768 | 20.1608 | 19.9365 | 19.3574 | 18.6423 | 18.0540 | (92) | |
| Temperature adjustment | | | | | | | | | | | | 0.0000 | | |
| adjusted MIT | 18.1014 | 18.3625 | 18.7574 | 19.2597 | 19.7129 | 20.0453 | 20.1768 | 20.1608 | 19.9365 | 19.3574 | 18.6423 | 18.0540 | (93) | |

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | | |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|-----------|--------------|---------|------|
| Utilisation | 0.9601 | 0.9405 | 0.9104 | 0.8567 | 0.7672 | 0.6274 | 0.4746 | 0.5134 | 0.7121 | 0.8723 | 0.9421 | 0.9655 | (94) | | |
| Useful gains | 496.1209 | 566.6518 | 606.1320 | 612.3609 | 567.6107 | 450.4641 | 326.4750 | 336.0537 | 444.2783 | 494.6710 | 479.3317 | 469.8925 | (95) | | |
| Ext temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | (96) | | |
| Heat loss rate W | 1404.4779 | 1367.1021 | 1242.1522 | 1039.6233 | 802.6390 | 540.7680 | 355.2050 | 372.8807 | 581.5468 | 877.2128 | 1160.4817 | 1398.3107 | (97) | | |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | (97a) | | |
| Space heating kWh | 675.8176 | 537.9026 | 473.1990 | 307.6289 | 174.8610 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 284.6111 | 490.4280 | 690.7431 | (98) | | |
| Space heating | | | | | | | | | | | | 3635.1913 | (98) | | |
| Space heating per m2 | | | | | | | | | | | | | (98) / (4) = | 37.0182 | (99) |

8c. Space cooling requirement

| Calculated for June, July and August. See Table 10b | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------|--------|
| Ext. temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | |
| Heat loss rate W | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 933.5047 | 734.8867 | 753.5394 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (100) |
| Utilisation | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.7430 | 0.8108 | 0.7895 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (101) |
| Useful loss | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 693.5858 | 595.8424 | 594.9177 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (102) |
| Total gains | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 943.7203 | 906.3338 | 869.4031 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (103) |
| Month fracti | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (103a) |
| Space cooling kWh | | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

| | | | | | | | | | | | | |
|--|--------|--------|--------|--------|--------|----------|----------|----------|--------|--------|--------|----------------|
| Space cooling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 180.0968 | 231.0057 | 204.2172 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (104) |
| Cooled fraction | | | | | | | | | | | | 615.3197 (104) |
| Intermittency factor (Table 10b) | | | | | | | | | | | | 1.0000 (105) |
| Space cooling kWh | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.2500 | 0.2500 | 0.2500 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (106) |
| Space cooling | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 45.0242 | 57.7514 | 51.0543 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (107) |
| Space cooling per m2 | | | | | | | | | | | | 153.8299 (107) |
| Energy for space heating | | | | | | | | | | | | 1.5665 (108) |
| Energy for space cooling | | | | | | | | | | | | 37.0182 (99) |
| Total | | | | | | | | | | | | 1.5665 (108) |
| Dwelling Fabric Energy Efficiency (DFEE) | | | | | | | | | | | | 38.5847 (109) |
| | | | | | | | | | | | | 38.6 (109) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m ²) | Storey height (m) | Volume (m ³) |
|--|------------------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m ³ per hour |
|---|--------------|-------------------|-----------------------------|----------------|-------------------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test | | | | Yes | |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.2500 (18) |
| Number of sides sheltered | | | | | 3 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.1938 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.7000 | 5.8000 | 5.7000 | 5.0000 | 4.6000 | 4.4000 | 4.0000 | 4.1000 | 4.6000 | 5.2000 | 5.3000 | 5.1000 (22) |
| Wind factor | 1.4250 | 1.4500 | 1.4250 | 1.2500 | 1.1500 | 1.1000 | 1.0000 | 1.0250 | 1.1500 | 1.3000 | 1.3250 | 1.2750 (22a) |
| Adj infilt rate | 0.2761 | 0.2809 | 0.2761 | 0.2422 | 0.2228 | 0.2131 | 0.1938 | 0.1986 | 0.2228 | 0.2519 | 0.2567 | 0.2470 (22b) |
| Mechanical extract ventilation - decentralised | | | | | | | | | | | | |
| If mechanical ventilation: | | | | | | | | | | | | 0.5000 (23a) |
| Effective ac | 0.5261 | 0.5309 | 0.5261 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5019 | 0.5067 | 0.5000 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m ² | Openings m ² | NetArea m ² | U-value W/m ² K | A x U W/K | K-value kJ/m ² K | A x K kJ/K |
|--|----------------------|-------------------------|------------------------|----------------------------|-----------|-----------------------------|---------------|
| Entrance Door | | | 2.1000 | 1.4000 | 2.9400 | | (26) |
| Windows/ Patios (Uw = 1.40) | | | 13.7800 | 1.3258 | 18.2689 | | (27) |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1200 | 5.8920 | | (28a) |
| Render/ Blk T/Frame | 96.5000 | 12.7000 | 83.8000 | 0.1600 | 13.4080 | | (29a) |
| Feature Stone | 8.4100 | 3.1800 | 5.2300 | 0.1600 | 0.8368 | | (29a) |
| Horizontal | 49.1000 | | 49.1000 | 0.1000 | 4.9100 | | (30) |
| Total net area of external elements Aum(A, m ²) | | | 203.1100 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | (26)...(30) + (32) = | 46.2557 | | (33) |
| Party Wall 1 | | | 45.9000 | 0.0000 | 0.0000 | | (32) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K | | | | | | | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6728 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 54.9285 (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m | 43.4739 | 43.8742 | 43.4739 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.4726 | 41.8729 | 41.3177 (38) |
| Heat transfer coeff | 98.4024 | 98.8027 | 98.4024 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.4011 | 96.8013 | 96.2461 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 96.8777 (39) |
| HLP | 1.0021 | 1.0061 | 1.0021 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9817 | 0.9858 | 0.9801 (40) |
| HLP (average) | | | | | | | | | | | | 0.9865 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Water storage loss: | 25.4614 | 22.2687 | 22.9793 | 20.0339 | 19.2230 | 16.5880 | 15.3712 | 17.6387 | 17.8494 | 20.8017 | 22.7067 | 24.6580 (46) |
| Store volume | | | | | | | | | | | | 250.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 2.2200 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.1988 (55) |
| Total storage loss | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (56) |
| If cylinder contains dedicated solar storage | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | 230.1679 | 203.0356 | 213.6206 | 192.0355 | 188.5787 | 169.0627 | 162.9000 | 178.0166 | 177.4718 | 199.1033 | 209.8540 | 224.8119 (62) |
| Solar input | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (63) |
| Output from w/h | 230.1679 | 203.0356 | 213.6206 | 192.0355 | 188.5787 | 169.0627 | 162.9000 | 178.0166 | 177.4718 | 199.1033 | 209.8540 | 224.8119 (64) |
| RHI water heating demand | | | | | | | | | | | | 2348.6586 (64) |
| Heat gains from water heating, kWh/month | 104.7796 | 93.0244 | 99.2776 | 91.1893 | 90.9512 | 83.5509 | 82.4130 | 87.4393 | 86.3469 | 94.4506 | 97.1140 | 102.9987 (65) |
| | | | | | | | | | | | 2349 (64) | |

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

| | | | | | | | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| (66)m | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.5551 | 53.7845 | 43.7405 | 33.1144 | 24.7534 | 20.8978 | 22.5809 | 29.3515 | 39.3955 | 50.0216 | 58.3826 | 62.2381 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 378.1859 | 382.1103 | 372.2209 | 351.1677 | 324.5918 | 299.6142 | 282.9277 | 279.0033 | 288.8926 | 309.9458 | 336.5217 | 361.4993 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 (71) |
| Water heating gains (Table 5) | 140.8328 | 138.4291 | 133.4377 | 126.6518 | 122.2462 | 116.0429 | 110.7702 | 117.5259 | 119.9263 | 126.9498 | 134.8805 | 138.4392 (72) |
| Total internal gains | 691.0739 | 685.8240 | 660.8992 | 622.4340 | 583.0915 | 548.0551 | 527.7789 | 537.3808 | 559.7144 | 598.4173 | 641.2849 | 673.6767 (73) |

6. Solar gains

| | | | | | | | | | | | | |
|-------------|----------|------------|---------------|---------------|-----------|--------------|----------|----------|----------|----------|----------|---------------|
| [Jan] | Area | Solar flux | Specific data | FF | Access | Gains | | | | | | |
| | m2 | Table 6a | g | Specific data | factor | W | | | | | | |
| | | W/m2 | or Table 6b | or Table 6c | Table 6d | | | | | | | |
| North | 5.8100 | 8.2005 | 0.6300 | 0.7000 | 0.7700 | 14.5609 (74) | | | | | | |
| East | 0.7200 | 14.7869 | 0.6300 | 0.7000 | 0.7700 | 3.2537 (76) | | | | | | |
| South | 7.2500 | 38.1750 | 0.6300 | 0.7000 | 0.7700 | 84.5841 (78) | | | | | | |
| Solar gains | 102.3987 | 197.0139 | 295.0105 | 369.6645 | 435.3197 | 401.3935 | 385.7586 | 347.9508 | 300.4342 | 212.5420 | 126.8290 | 80.1289 (83) |
| Total gains | 793.4726 | 882.8379 | 955.9097 | 992.0985 | 1018.4113 | 949.4485 | 913.5375 | 885.3316 | 860.1486 | 810.9593 | 768.1139 | 753.8056 (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| tau | 27.7206 | 27.6083 | 27.7206 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.2961 | 28.1791 | 28.3417 |
| alpha | 2.8480 | 2.8406 | 2.8480 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8864 | 2.8786 | 2.8894 |
| util living area | 0.9390 | 0.9206 | 0.8889 | 0.8415 | 0.7790 | 0.6991 | 0.6218 | 0.6406 | 0.7455 | 0.8611 | 0.9211 | 0.9476 (86) |
| MIT | 19.0889 | 19.2644 | 19.6102 | 20.0278 | 20.3567 | 20.6458 | 20.7956 | 20.7753 | 20.5651 | 20.0769 | 19.5077 | 19.0132 (87) |
| Th 2 | 20.0816 | 20.0782 | 20.0816 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0986 | 20.0952 | 20.0999 (88) |
| util rest of house | 0.9315 | 0.9111 | 0.8754 | 0.8218 | 0.7504 | 0.6557 | 0.5647 | 0.5844 | 0.7053 | 0.8402 | 0.9103 | 0.9411 (89) |
| MIT 2 | 17.5195 | 17.7680 | 18.2637 | 18.8659 | 19.3208 | 19.7098 | 19.8983 | 19.8754 | 19.6104 | 18.9446 | 18.1336 | 17.4215 (90) |
| Living area fraction | | | | | | | | | | | | 0.1751 (91) |
| MIT | 17.7942 | 18.0299 | 18.4994 | 19.0692 | 19.5021 | 19.8737 | 20.0553 | 20.0329 | 19.7775 | 19.1428 | 18.3742 | 17.7002 (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 |
| adjusted MIT | 17.6442 | 17.8799 | 18.3494 | 18.9192 | 19.3521 | 19.7237 | 19.9053 | 19.8829 | 19.6275 | 18.9928 | 18.2242 | 17.5502 (93) |

8. Space heating requirement

| | | | | | | | | | | | | |
|--------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| | 0.9047 | 0.8816 | 0.8440 | 0.7913 | 0.7235 | 0.6357 | 0.5513 | 0.5696 | 0.6815 | 0.8091 | 0.8813 | 0.9165 (94) |
| Useful gains | 717.8691 | 778.3397 | 806.7423 | 785.0603 | 736.8618 | 603.5201 | 503.6427 | 504.3260 | 586.1823 | 656.1622 | 676.9239 | 690.8500 (95) |
| Ext temp. | 3.3000 | 3.6000 | 5.0000 | 7.0000 | 9.3000 | 12.2000 | 14.0000 | 13.9000 | 12.0000 | 8.8000 | 5.7000 | 2.9000 (96) |
| Heat loss rate W | 1411.5044 | 1410.8947 | 1313.6102 | 1137.5569 | 967.4771 | 724.1229 | 568.3669 | 575.8323 | 734.1190 | 982.5944 | 1212.3546 | 1410.0208 (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 (97a) |
| Space heating kWh | 516.0647 | 425.0769 | 377.1097 | 253.7976 | 171.5778 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 242.8655 | 385.5101 | 535.0631 (98) |
| Space heating | | | | | | | | | | | | 2907.0654 (98) |
| RHI space heating demand | | | | | | | | | | | | 2907 (98) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-----------------------------|----------------|-------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.2500 (18) |
| Number of sides sheltered | | | | | 3 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.1938 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22) |
| Wind factor | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.2470 | 0.2422 | 0.2373 | 0.2131 | 0.2083 | 0.1841 | 0.1841 | 0.1792 | 0.1938 | 0.2083 | 0.2180 | 0.2277 (22b) |
| Mechanical extract ventilation - decentralised | | | | | | | | | | | | |
| If mechanical ventilation: | | | | | | | | | | | | 0.5000 (23a) |
| Effective ac | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|---------------|----------------------|----------------|---------------|
| Entrance Door | | | 2.1000 | 1.4000 | 2.9400 | | (26) |
| Windows/ Patios (Uw = 1.40) | | | 13.7800 | 1.3258 | 18.2689 | | (27) |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1200 | 5.8920 | | (28a) |
| Render/ Blk T/Frame | 96.5000 | 12.7000 | 83.8000 | 0.1600 | 13.4080 | | (29a) |
| Feature Stone | 8.4100 | 3.1800 | 5.2300 | 0.1600 | 0.8368 | | (29a) |
| Horizontal | 49.1000 | | 49.1000 | 0.1000 | 4.9100 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 203.1100 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 46.2557 | (33) |
| Party Wall 1 | | | 45.9000 | 0.0000 | 0.0000 | | (32) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6728 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 54.9285 (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 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 (38) |
| Heat transfer coeff | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 96.2461 (39) |
| HLP | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 (40) |
| HLP (average) | | | | | | | | | | | | 0.9801 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---|
| Water storage loss: | 25.4614 | 22.2687 | 22.9793 | 20.0339 | 19.2230 | 16.5880 | 15.3712 | 17.6387 | 17.8494 | 20.8017 | 22.7067 | 24.6580 (46) |
| Store volume | | | | | | | | | | | | 250.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 2.2200 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.1988 (55) |
| Total storage loss | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (56) |
| If cylinder contains dedicated solar storage | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | 230.1679 | 203.0356 | 213.6206 | 192.0355 | 188.5787 | 169.0627 | 162.9000 | 178.0166 | 177.4718 | 199.1033 | 209.8540 | 224.8119 (62) |
| Solar input | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (63) |
| FGHRS | -30.9126 | -27.0122 | -27.5076 | -23.3233 | -17.4530 | -10.4266 | -10.0486 | -10.9782 | -10.9438 | -22.6069 | -27.2819 | -30.4126 eq.(G6) |
| Output from w/h | 199.2553 | 176.0234 | 186.1130 | 168.7122 | 171.1256 | 158.6361 | 152.8515 | 167.0383 | 166.5280 | 176.4965 | 182.5721 | 194.3993 (64) |
| Heat gains from water heating, kWh/month | 104.7796 | 93.0244 | 99.2776 | 91.1893 | 90.9512 | 83.5509 | 82.4130 | 87.4393 | 86.3469 | 94.4506 | 97.1140 | 102.9987 (65) |
| | | | | | | | | | | | | Total per year (kWh/year) = Sum(64)m = 2099.7514 (64) |

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

| | | | | | | | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| (66)m | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.5551 | 53.7845 | 43.7405 | 33.1144 | 24.7534 | 20.8978 | 22.5809 | 29.3515 | 39.3955 | 50.0216 | 58.3826 | 62.2381 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 378.1859 | 382.1103 | 372.2209 | 351.1677 | 324.5918 | 299.6142 | 282.9277 | 279.0033 | 288.8926 | 309.9458 | 336.5217 | 361.4993 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 (71) |
| Water heating gains (Table 5) | 140.8328 | 138.4291 | 133.4377 | 126.6518 | 122.2462 | 116.0429 | 110.7702 | 117.5259 | 119.9263 | 126.9498 | 134.8805 | 138.4392 (72) |
| Total internal gains | 691.0739 | 685.8240 | 660.8992 | 622.4340 | 583.0915 | 548.0551 | 527.7789 | 537.3808 | 559.7144 | 598.4173 | 641.2849 | 673.6767 (73) |

6. Solar gains

| | | | | | | | | | | | | |
|-------------|------------|--------------------------------|------------------------------|-----------------------------------|------------------------------------|---------------|----------|----------|----------|----------|----------|---------------|
| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | g Specific data or Table 6c | FF Access factor Table 6d | Gains W | | | | | | |
| North | 5.8100 | 10.6334 | 0.6300 | 0.7000 | 0.7700 | 18.8808 (74) | | | | | | |
| East | 0.7200 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 4.3217 (76) | | | | | | |
| South | 7.2500 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 103.5883 (78) | | | | | | |
| Solar gains | 126.7907 | 214.1871 | 291.3402 | 363.0345 | 412.0704 | 412.4374 | 396.1706 | 358.4453 | 315.6574 | 235.9670 | 151.4679 | 108.8037 (83) |
| Total gains | 817.8646 | 900.0111 | 952.2394 | 985.4686 | 995.1619 | 960.4925 | 923.9494 | 895.8261 | 875.3718 | 834.3843 | 792.7529 | 782.4804 (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| tau | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 |
| alpha | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 |
| util living area | 0.9248 | 0.9008 | 0.8640 | 0.8013 | 0.7023 | 0.5638 | 0.4310 | 0.4593 | 0.6335 | 0.8061 | 0.8967 | 0.9326 (86) |
| MIT | 19.3551 | 19.5717 | 19.8926 | 20.2752 | 20.6208 | 20.8561 | 20.9511 | 20.9396 | 20.7882 | 20.3653 | 19.7880 | 19.2850 (87) |
| Th 2 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 (88) |
| util rest of house | 0.9154 | 0.8886 | 0.8469 | 0.7752 | 0.6615 | 0.5021 | 0.3518 | 0.3804 | 0.5755 | 0.7758 | 0.8820 | 0.9241 (89) |
| MIT 2 | 17.9142 | 18.2223 | 18.6772 | 19.2109 | 19.6749 | 19.9665 | 20.0665 | 20.0565 | 19.8913 | 19.3440 | 18.5370 | 17.8143 (90) |
| Living area fraction | | | | | | | | | | | | fLA = Living area / (4) = 0.1751 (91) |
| MIT | 18.1664 | 18.4585 | 18.8900 | 19.3972 | 19.8405 | 20.1222 | 20.2213 | 20.2111 | 20.0483 | 19.5228 | 18.7560 | 18.0718 (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 |
| adjusted MIT | 18.0164 | 18.3085 | 18.7400 | 19.2472 | 19.6905 | 19.9722 | 20.0713 | 20.0611 | 19.8983 | 19.3728 | 18.6060 | 17.9218 (93) |

8. Space heating requirement

| | | | | | | | | | | | | |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|
| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| | 0.8871 | 0.8583 | 0.8159 | 0.7468 | 0.6411 | 0.4927 | 0.3491 | 0.3768 | 0.5614 | 0.7473 | 0.8513 | 0.8967 (94) |
| Useful gains | 725.5058 | 772.4863 | 776.9191 | 735.9321 | 637.9796 | 473.2376 | 322.5953 | 337.5493 | 491.4030 | 623.5242 | 674.8914 | 701.6544 (95) |
| Ext temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 (96) |
| Heat loss rate W | 1320.1505 | 1290.5189 | 1178.0521 | 995.8780 | 769.0536 | 517.0572 | 334.1002 | 352.3651 | 558.0652 | 844.3478 | 1107.4094 | 1320.6676 (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 (97a) |
| Space heating kWh | 442.4157 | 348.1179 | 298.4430 | 187.1611 | 97.5190 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 164.2928 | 311.4130 | 460.5458 (98) |
| Space heating | | | | | | | | | | | | 2309.9082 (98) |
| Space heating per m2 | | | | | | | | | | | | (98) / (4) = 23.5225 (99) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 91.2000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | 442.4157 | 348.1179 | 298.4430 | 187.1611 | 97.5190 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 164.2928 | 311.4130 | 460.5458 | (98) |
| Space heating efficiency (main heating system 1) | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 91.2000 | 91.2000 | 91.2000 | (210) |
| Space heating fuel (main heating system) | 485.1049 | 381.7082 | 327.2401 | 205.2205 | 106.9288 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 180.1456 | 341.4616 | 504.9844 | (211) |
| Water heating requirement | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (215) |
| Water heating requirement | 199.2553 | 176.0234 | 186.1130 | 168.7122 | 171.1256 | 158.6361 | 152.8515 | 167.0383 | 166.5280 | 176.4965 | 182.5721 | 194.3993 | (64) |
| Efficiency of water heater (217)m | 87.5849 | 87.3029 | 86.7701 | 85.7938 | 84.0809 | 80.5000 | 80.5000 | 80.5000 | 80.5000 | 85.3262 | 86.9295 | 87.7385 | (217) |
| Fuel for water heating, kWh/month | 227.4995 | 201.6237 | 214.4897 | 196.6485 | 203.5249 | 197.0635 | 189.8776 | 207.5011 | 206.8671 | 206.8491 | 210.0232 | 221.5668 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2483.5347 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2532.7941 (211) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 (215) |
| Electricity for pumps and fans: | | | | | | | | | | | | | |
| (MEV)Decentralised, Database: total watage = 8.7725, total flow = 37.0000, SFP = 0.2371) | | | | | | | | | | | | | |
| mechanical ventilation fans (SFP = 0.2371) | | | | | | | | | | | | | 72.4324 (230a) |
| central heating pump | | | | | | | | | | | | | 30.0000 (230c) |
| main heating flue fan | | | | | | | | | | | | | 45.0000 (230e) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 147.4324 (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 427.7687 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 1.01 * 1080 * 1.00) = | | | | | | | | | | -872.2559 | | | -872.2559 (233) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4719.2741 (238) |

10a. Fuel costs - using Table 12 prices

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1 | 2532.7941 | 7.6000 | 192.4924 (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (242) |
| Water heating (other fuel) | 2483.5347 | 7.6000 | 188.7486 (247) |
| Mechanical ventilation fans | 72.4324 | 13.1900 | 9.5538 (249) |
| Pumps and fans for heating | 75.0000 | 13.1900 | 9.8925 (249) |
| Energy for lighting | 427.7687 | 13.1900 | 56.4227 (250) |
| Additional standing charges | | | 70.0000 (251) |
| Energy saving/generation technologies | | | |
| PV Unit | -872.2559 | 13.1900 | -115.0506 (252) |
| Total energy cost | | | 412.0595 (255) |

11a. SAP rating - Individual heating systems

| | | |
|----------------------------------|---|--------------|
| Energy cost deflator (Table 12): | | 0.4200 (256) |
| Energy cost factor (ECF) | $[(255) \times (256)] / [(4) + 45.0] =$ | 1.2086 (257) |
| SAP value | | 83.1407 |
| SAP rating (Section 12) | | 83 (258) |
| SAP band | | B |

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---------------------------------------|-----------------|----------------------------|-----------------------|
| Space heating - main system 1 | 2532.7941 | 0.2410 | 610.4034 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 2483.5347 | 0.2410 | 598.5319 (264) |
| Space and water heating | | | 1208.9352 (265) |
| Pumps and fans | 147.4324 | 0.5190 | 76.5174 (267) |
| Energy for lighting | 427.7687 | 0.5190 | 222.0120 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -872.2559 | 0.5190 | -452.7008 (269) |
| Total kg/year | | | 1054.7638 (272) |
| CO2 emissions per m2 | | | 10.7400 (273) |
| EI value | | | 90.1300 |
| EI rating | | | 90 (274) |
| EI band | | | B |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

| | |
|------------------------------------|---|
| Main heating energy efficiency | $7.60 \times (1 + 0.29 \times 0.00) / 0.9120 = 8.333$, stars = 2 |
| Main heating environmental impact | $0.241 \times (1 + 0.29 \times 0.00) / 0.9120 = 0.2643$, stars = 4 |
| Water heating energy efficiency | $7.60 / 0.8446 = 8.998$, stars = 3 |
| Water heating environmental impact | $0.241 / 0.8446 = 0.2853$, stars = 5 |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-----------------------------|----------------|-------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.2500 (18) |
| Number of sides sheltered | | | | | 3 (19) |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.1938 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.7000 | 5.8000 | 5.7000 | 5.0000 | 4.6000 | 4.4000 | 4.0000 | 4.1000 | 4.6000 | 5.2000 | 5.3000 | 5.1000 (22) |
| Wind factor | 1.4250 | 1.4500 | 1.4250 | 1.2500 | 1.1500 | 1.1000 | 1.0000 | 1.0250 | 1.1500 | 1.3000 | 1.3250 | 1.2750 (22a) |
| Adj infilt rate | 0.2761 | 0.2809 | 0.2761 | 0.2422 | 0.2228 | 0.2131 | 0.1938 | 0.1986 | 0.2228 | 0.2519 | 0.2567 | 0.2470 (22b) |
| Mechanical extract ventilation - decentralised | | | | | | | | | | | | |
| If mechanical ventilation: | | | | | | | | | | | | 0.5000 (23a) |
| Effective ac | 0.5261 | 0.5309 | 0.5261 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5019 | 0.5067 | 0.5000 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|---------------|------------------------------|----------------|---------------|
| Entrance Door | | | 2.1000 | 1.4000 | 2.9400 | | (26) |
| Windows/ Patios (Uw = 1.40) | | | 13.7800 | 1.3258 | 18.2689 | | (27) |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1200 | 5.8920 | | (28a) |
| Render/ Blk T/Frame | 96.5000 | 12.7000 | 83.8000 | 0.1600 | 13.4080 | | (29a) |
| Feature Stone | 8.4100 | 3.1800 | 5.2300 | 0.1600 | 0.8368 | | (29a) |
| Horizontal | 49.1000 | | 49.1000 | 0.1000 | 4.9100 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 203.1100 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 46.2557 | | (33) |
| Party Wall 1 | | | 45.9000 | 0.0000 | 0.0000 | | (32) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6728 (36) |
| Total fabric heat loss | | | | | | (33) + (36) = | 54.9285 (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m | 43.4739 | 43.8742 | 43.4739 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.4726 | 41.8729 | 41.3177 (38) |
| Heat transfer coeff | 98.4024 | 98.8027 | 98.4024 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.4011 | 96.8013 | 96.2461 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 96.8777 (39) |
| HLP | 1.0021 | 1.0061 | 1.0021 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9817 | 0.9858 | 0.9801 (40) |
| HLP (average) | | | | | | | | | | | | 0.9865 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------------------|
| Water storage loss: | 25.4614 | 22.2687 | 22.9793 | 20.0339 | 19.2230 | 16.5880 | 15.3712 | 17.6387 | 17.8494 | 20.8017 | 22.7067 | 24.6580 (46) |
| Store volume | | | | | | | | | | | | 250.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 2.2200 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.1988 (55) |
| Total storage loss | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (56) |
| If cylinder contains dedicated solar storage | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (57) |
| Primary loss | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | 230.1679 | 203.0356 | 213.6206 | 192.0355 | 188.5787 | 169.0627 | 162.9000 | 178.0166 | 177.4718 | 199.1033 | 209.8540 | 224.8119 (62) |
| Solar input | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 (63) |
| FGHRS | -31.6192 | -27.7092 | -28.2300 | -24.5750 | -21.8769 | -10.4266 | -10.0486 | -10.9782 | -10.9438 | -25.2287 | -27.9587 | -31.1181 eq. (G6) |
| Output from w/h | 198.5486 | 175.3265 | 185.3906 | 167.4604 | 166.7018 | 158.6361 | 152.8515 | 167.0383 | 166.5280 | 173.8747 | 181.8953 | 193.6938 (64) |
| Heat gains from water heating, kWh/month | 104.7796 | 93.0244 | 99.2776 | 91.1893 | 90.9512 | 83.5509 | 82.4130 | 87.4393 | 86.3469 | 94.4506 | 97.1140 | 102.9987 (65) |
| | | | | | | | | | | | | 2087.9457 (64) |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| (66)m | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.5551 | 53.7845 | 43.7405 | 33.1144 | 24.7534 | 20.8978 | 22.5809 | 29.3515 | 39.3955 | 50.0216 | 58.3826 | 62.2381 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 378.1859 | 382.1103 | 372.2209 | 351.1677 | 324.5918 | 299.6142 | 282.9277 | 279.0033 | 288.8926 | 309.9458 | 336.5217 | 361.4993 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 (71) |
| Water heating gains (Table 5) | 140.8328 | 138.4291 | 133.4377 | 126.6518 | 122.2462 | 116.0429 | 110.7702 | 117.5259 | 119.9263 | 126.9498 | 134.8805 | 138.4392 (72) |
| Total internal gains | 691.0739 | 685.8240 | 660.8992 | 622.4340 | 583.0915 | 548.0551 | 527.7789 | 537.3808 | 559.7144 | 598.4173 | 641.2849 | 673.6767 (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data or Table 6b | Specific data FF or Table 6c | Access factor Table 6d | Gains W | | | | | | |
|-------------|----------|--------------------------|---------------------------|------------------------------|------------------------|--------------|----------|----------|----------|----------|----------|---------------|
| North | 5.8100 | 8.2005 | 0.6300 | 0.7000 | 0.7700 | 14.5609 (74) | | | | | | |
| East | 0.7200 | 14.7869 | 0.6300 | 0.7000 | 0.7700 | 3.2537 (76) | | | | | | |
| South | 7.2500 | 38.1750 | 0.6300 | 0.7000 | 0.7700 | 84.5841 (78) | | | | | | |
| Solar gains | 102.3987 | 197.0139 | 295.0105 | 369.6645 | 435.3197 | 401.3935 | 385.7586 | 347.9508 | 300.4342 | 212.5420 | 126.8290 | 80.1289 (83) |
| Total gains | 793.4726 | 882.8379 | 955.9097 | 992.0985 | 1018.4113 | 949.4485 | 913.5375 | 885.3316 | 860.1486 | 810.9593 | 768.1139 | 753.8056 (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 27.7206 | 27.6083 | 27.7206 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.2961 | 28.1791 | 28.3417 (85) |
| alpha | 2.8480 | 2.8406 | 2.8480 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8864 | 2.8786 | 2.8894 |
| util living area | 0.9390 | 0.9206 | 0.8889 | 0.8415 | 0.7790 | 0.6991 | 0.6218 | 0.6406 | 0.7455 | 0.8611 | 0.9211 | 0.9476 (86) |
| MIT | 19.0889 | 19.2644 | 19.6102 | 20.0278 | 20.3567 | 20.6458 | 20.7956 | 20.7753 | 20.5651 | 20.0769 | 19.5077 | 19.0132 (87) |
| Th 2 | 20.0816 | 20.0782 | 20.0816 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0986 | 20.0952 | 20.0999 (88) |
| util rest of house | 0.9315 | 0.9111 | 0.8754 | 0.8218 | 0.7504 | 0.6557 | 0.5647 | 0.5844 | 0.7053 | 0.8402 | 0.9103 | 0.9411 (89) |
| MIT 2 | 17.5195 | 17.7680 | 18.2637 | 18.8659 | 19.3208 | 19.7098 | 19.8983 | 19.8754 | 19.6104 | 18.9446 | 18.1336 | 17.4215 (90) |
| Living area fraction | 17.7942 | 18.0299 | 18.4994 | 19.0692 | 19.5021 | 19.8737 | 20.0553 | 20.0329 | 19.7775 | 19.1428 | 18.3742 | 17.7002 (92) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 |
| adjusted MIT | 17.6442 | 17.8799 | 18.3494 | 18.9192 | 19.3521 | 19.7237 | 19.9053 | 19.8829 | 19.6275 | 18.9928 | 18.2242 | 17.5502 (93) |

8. Space heating requirement

| Utilisation | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|
| Useful gains | 0.9047 | 0.8816 | 0.8440 | 0.7913 | 0.7235 | 0.6357 | 0.5513 | 0.5696 | 0.6815 | 0.8091 | 0.8813 | 0.9165 (94) |
| Ext temp. | 717.8691 | 778.3397 | 806.7423 | 785.0603 | 736.8618 | 603.5201 | 503.6427 | 504.3260 | 586.1823 | 656.1622 | 676.9239 | 690.8500 (95) |
| Heat loss rate W | 3.3000 | 3.6000 | 5.0000 | 7.1000 | 9.3000 | 12.2000 | 14.0000 | 13.9000 | 12.0000 | 8.8000 | 5.7000 | 2.9000 (96) |
| Month fracti | 1411.5044 | 1410.8947 | 1313.6102 | 1137.5569 | 967.4771 | 724.1229 | 568.3669 | 575.8323 | 734.1190 | 982.5944 | 1212.3546 | 1410.0208 (97) |
| Space heating kWh | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 (97a) |
| Space heating per m2 | 516.0647 | 425.0769 | 377.1097 | 253.7976 | 171.5778 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 242.8655 | 385.5101 | 535.0631 (98) |
| | | | | | | | | | | | | 2907.0654 (98) |
| | | | | | | | | | | | | (98) / (4) = 29.6035 (99) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 91.2000 (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 (208) |
| Space heating requirement | 516.0647 | 425.0769 | 377.1097 | 253.7976 | 171.5778 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 242.8655 | 385.5101 | 535.0631 | (98) |
| Space heating efficiency (main heating system 1) | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 91.2000 | 91.2000 | 91.2000 | (210) |
| Space heating fuel (main heating system) | 565.8604 | 466.0931 | 413.4974 | 278.2868 | 188.1336 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 266.2999 | 422.7085 | 586.6920 | (211) |
| Water heating requirement | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (215) |
| Water heating requirement | 198.5486 | 175.3265 | 185.3906 | 167.4604 | 166.7018 | 158.6361 | 152.8515 | 167.0383 | 166.5280 | 173.8747 | 181.8953 | 193.6938 | (64) |
| Efficiency of water heater (217)m | 87.9519 | 87.7924 | 87.3724 | 86.6230 | 85.5935 | 80.5000 | 80.5000 | 80.5000 | 80.5000 | 86.4080 | 87.4727 | 88.0880 | (216) |
| Fuel for water heating, kWh/month | 225.7468 | 199.7058 | 212.1844 | 193.3211 | 194.7599 | 197.0635 | 189.8776 | 207.5011 | 206.8671 | 201.2251 | 207.9451 | 219.8867 | (219) |
| Water heating fuel used | | | | | | | | | | | | | 2456.0841 (219) |
| Annual totals kWh/year | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 3187.5718 (211) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 (215) |
| Electricity for pumps and fans: | | | | | | | | | | | | | |
| (MEV)Decentralised, Database: total watage = 8.7725, total flow = 37.0000, SFP = 0.2371) | | | | | | | | | | | | | |
| mechanical ventilation fans (SFP = 0.2371) | | | | | | | | | | | | | 72.4324 (230a) |
| central heating pump | | | | | | | | | | | | | 30.0000 (230c) |
| main heating flue fan | | | | | | | | | | | | | 45.0000 (230e) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 147.4324 (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 427.7687 (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 1.01 * 1017 * 1.00) = | | | | | | | | | | -821.8849 | | | -821.8849 (233) |
| Total delivered energy for all uses | | | | | | | | | | | | | 5396.9721 (238) |

10a. Fuel costs - using BEDF prices (510)

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year | |
|---------------------------------------|---------------|------------------|------------------|--|
| Space heating - main system 1 | 3187.5718 | 6.9800 | 222.4925 (240) | |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (242) | |
| Water heating (other fuel) | 2456.0841 | 6.9800 | 171.4347 (247) | |
| Mechanical ventilation fans | 72.4324 | 22.5500 | 16.3335 (249) | |
| Pumps and fans for heating | 75.0000 | 22.5500 | 16.9125 (249) | |
| Energy for lighting | 427.7687 | 22.5500 | 96.4618 (250) | |
| Additional standing charges | | | 63.0000 (251) | |
| Energy saving/generation technologies | | | | |
| PV Unit | -821.8849 | 22.5500 | -185.3351 (252) | |
| Total energy cost | | | 401.3000 (255) | |

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---------------------------------------|-----------------|----------------------------|-----------------------|--|
| Space heating - main system 1 | 3187.5718 | 0.2410 | 768.2048 (261) | |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) | |
| Water heating (other fuel) | 2456.0841 | 0.2410 | 591.9163 (264) | |
| Space and water heating | | | 1360.1211 (265) | |
| Pumps and fans | 147.4324 | 0.5190 | 76.5174 (267) | |
| Energy for lighting | 427.7687 | 0.5190 | 222.0120 (268) | |
| Energy saving/generation technologies | | | | |
| PV Unit | -821.8849 | 0.5190 | -426.5583 (269) | |
| Total kg/year | | | 1232.0922 (272) | |

13a. Primary energy - Individual heating systems including micro-CHP

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year | |
|-------------------------------|-----------------|----------------------------------|-------------------------|--|
| Space heating - main system 1 | 3187.5718 | 1.0900 | 3474.4532 (261) | |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) | |
| Water heating (other fuel) | 2456.0841 | 1.0900 | 2677.1317 (264) | |
| Space and water heating | | | 6151.5849 (265) | |
| Pumps and fans | 147.4324 | 3.0700 | 452.6176 (267) | |
| Energy for lighting | 427.7687 | 3.0700 | 1313.2500 (268) | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

| | | | |
|---|-----------|--------|------------------|
| Energy saving/generation technologies | | | |
| PV Unit | -821.8849 | 3.0700 | -2523.1868 (269) |
| Primary energy kWh/year | | | 5394.2658 (272) |
| Primary energy kWh/m ² /year | | | 54.9314 (273) |

SAP 2012 EPC IMPROVEMENTS

(For testing purposes):

| | |
|-----------------------------|-------------------|
| A | Not considered |
| B | Not considered |
| C | Not considered |
| D | Not considered |
| E Low energy lighting | Already installed |
| F | Not considered |
| G | Not considered |
| H | Not considered |
| I | Not considered |
| J | Not considered |
| K | Not considered |
| M | Not considered |
| N Solar water heating | Recommended |
| O | Not considered |
| P | Not considered |
| R | Not considered |
| S | Not considered |
| T | Not considered |
| U Solar photovoltaic panels | Already installed |
| A2 | Not considered |
| A3 | Not considered |
| T2 | Not considered |
| W | Not considered |
| X | Not considered |
| Y | Not considered |
| J2 | Not considered |
| Q2 | Not considered |
| Z1 | Not considered |
| Z2 | Not considered |
| Z3 | Not considered |
| Z4 | Not considered |
| Z5 | Not considered |
| V2 Wind turbine | Not applicable |
| L2 | Not considered |
| Q3 | Not considered |
| O3 | Not considered |

| | | | |
|-----------------------|------------|-------------|-----------------|
| Recommended measures: | SAP change | Cost change | CO2 change |
| N Solar water heating | + 3.5 | -£ 71 | -259 kg (21.0%) |

| | |
|--------------------------------------|------|
| Current energy efficiency rating: | B 83 |
| Current environmental impact rating: | B 90 |

| Recommended measures | Typical annual savings | Energy efficiency | Environmental impact |
|----------------------|---|-------------------|----------------------|
| Solar water heating | £71 2.64 kg/m ² | B 87 | A 93 |
| Total Savings | £71 2.64 kg/m² | | |

| | |
|--|------|
| Potential energy efficiency rating: | B 87 |
| Potential environmental impact rating: | A 93 |

Fuel prices for cost data on this page from database revision number 510 TEST (21 Dec 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, North East Scotland):

| | Current | Potential | Saving |
|----------------------------------|-----------------------|-----------------------|-----------------------|
| Electricity | £130 | £141 | -£11 |
| Bulk LPG | £457 | £374 | £83 |
| Space heating | £319 | £322 | -£3 |
| Water heating | £171 | £97 | £74 |
| Lighting | £96 | £96 | £0 |
| Generated (PV) | -£185 | -£185 | £0 |
| Total cost of fuels | £402 | £330 | £72 |
| Total cost of uses | £401 | £330 | £71 |
| Delivered energy | 55 kWh/m ² | 43 kWh/m ² | 12 kWh/m ² |
| Carbon dioxide emissions | 1.2 tonnes | 1.0 tonnes | 0.3 tonnes |
| CO2 emissions per m ² | 13 kg/m ² | 10 kg/m ² | 3 kg/m ² |
| Primary energy | 55 kWh/m ² | 43 kWh/m ² | 12 kWh/m ² |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour |
|---|--------------|-------------------|-------|-----------------------------|-------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans | | | | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test | | | | | Yes |
| Measured/design AP50 | | | | | 5.0000 |
| Infiltration rate | | | | | 0.2500 (18) |
| Number of sides sheltered | | | | | 3 (19) |
| Shelter factor | | | | (20) = 1 - [0.075 x (19)] = | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | | | | (21) = (18) x (20) = | 0.1938 (21) |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22) |
| Wind factor | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.2470 | 0.2422 | 0.2373 | 0.2131 | 0.2083 | 0.1841 | 0.1841 | 0.1792 | 0.1938 | 0.2083 | 0.2180 | 0.2277 (22b) |
| Mechanical extract ventilation - decentralised | | | | | | | | | | | | |
| If mechanical ventilation: | | | | | | | | | | | | 0.5000 (23a) |
| Effective ac | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K |
|--|----------|-------------|------------|---------------|------------------------------|----------------|----------------------------|
| Entrance Door | | | 2.1000 | 1.4000 | 2.9400 | | (26) |
| Windows/ Patios (Uw = 1.40) | | | 13.7800 | 1.3258 | 18.2689 | | (27) |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1200 | 5.8920 | | (28a) |
| Render/ Blk T/Frame | 96.5000 | 12.7000 | 83.8000 | 0.1600 | 13.4080 | | (29a) |
| Feature Stone | 8.4100 | 3.1800 | 5.2300 | 0.1600 | 0.8368 | | (29a) |
| Horizontal | 49.1000 | | 49.1000 | 0.1000 | 4.9100 | | (30) |
| Total net area of external elements Aum(A, m2) | | | 203.1100 | | | | (31) |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = 46.2557 | | (33) |
| Party Wall 1 | | | 45.9000 | 0.0000 | 0.0000 | | (32) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 100.0000 (35) |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6728 (36) |
| Total fabric heat loss | | | | | | | (33) + (36) = 54.9285 (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 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 | 41.3177 (38) |
| Heat transfer coeff | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 96.2461 (39) |
| HLP | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 | 0.9801 (40) |
| HLP (average) | | | | | | | | | | | | 0.9801 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-------------------|
| Water storage loss: | 25.4614 | 22.2687 | 22.9793 | 20.0339 | 19.2230 | 16.5880 | 15.3712 | 17.6387 | 17.8494 | 20.8017 | 22.7067 | 24.6580 (46) |
| Store volume | | | | | | | | | | | | 250.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 2.2200 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.1988 (55) |
| Total storage loss | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (56) |
| If cylinder contains dedicated solar storage | 26.0140 | 23.4965 | 26.0140 | 25.1748 | 26.0140 | 25.1748 | 26.0140 | 26.0140 | 25.1748 | 26.0140 | 25.1748 | 26.0140 (57) |
| Primary loss | 23.2624 | 21.0112 | 21.8667 | 15.7584 | 10.4681 | 9.9053 | 10.2355 | 11.1660 | 17.1091 | 21.8667 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | 219.0190 | 192.9657 | 201.0760 | 174.4927 | 164.6355 | 145.6668 | 138.7243 | 154.7713 | 161.2797 | 186.5587 | 199.0648 | 213.6631 (62) |
| Aperture area of solar collector | | | | | | | | | | | | 3.0000 (H1) |
| Zero-loss collector efficiency | | | | | | | | | | | | 0.7000 (H2) |
| Collector heat loss coefficient | | | | | | | | | | | | 1.8000 (H3) |
| Collector 2nd order heat loss coefficient | | | | | | | | | | | | 0.0050 (H3a) |
| Collector effective heat loss coefficient | | | | | | | | | | | | 1.8063 (H3b) |
| Collector performance ratio | | | | | | | | | | | | 2.5804 (H4) |
| Annual solar radiation per m2 | | | | | | | | | | | | 1079.5246 (H5) |
| Overshading factor | | | | | | | | | | | | 0.8000 (H6) |
| Solar energy available | | | | | | | | | | | | 1813.6014 (H7) |
| Adjustment factor for showers | | | | | | | | | | | | 1.0000 (H7a) |
| Solar-to-load ratio | | | | | | | | | | | | 1.1077 (H8) |
| Utilisation factor | | | | | | | | | | | | 0.5945 (H9) |
| Collector performance factor | | | | | | | | | | | | 0.8793 (H10) |
| Dedicated solar storage volume | | | | | | | | | | | | 75.0000 (H11) |
| Effective solar volume | | | | | | | | | | | | 127.5000 (H13) |
| Daily hot water demand | | | | | | | | | | | | 104.0557 (H14) |
| Volume ratio Veff/V | | | | | | | | | | | | 1.2253 (H15) |
| Solar storage volume factor | | | | | | | | | | | | 1.0000 (H16) |
| Solar input | | | | | | | | | | | | -948.1067 (H17) |
| Solar input | -27.4932 | -45.8783 | -78.1359 | -104.7175 | -129.3697 | -127.1910 | -125.5101 | -109.6588 | -85.8849 | -58.6492 | -32.6109 | -23.0071 (63) |
| FGHRS | -26.7861 | -20.5893 | -16.5863 | -7.3948 | 0.0000 | 0.0000 | 0.0000 | -2.7930 | -4.6579 | -15.3672 | -22.5770 | -26.8366 eq. (G6) |
| Output from w/h | 164.7398 | 126.4982 | 106.3538 | 62.3803 | 35.2658 | 18.4758 | 13.2141 | 42.3195 | 70.7369 | 112.5423 | 143.8769 | 163.8193 (64) |
| Heat gains from water heating, kWh/month | 95.8605 | 84.9684 | 89.2420 | 77.1551 | 71.7967 | 64.8341 | 63.0724 | 68.8431 | 73.3932 | 84.4150 | 88.4826 | 94.0797 (65) |
| Total per year (kWh/year) = Sum(64)m = 1060.2229 (64) | | | | | | | | | | | | |

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

| | | | | | | | | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------------|
| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (66) |
| (66)m | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.5551 | 53.7845 | 43.7405 | 33.1144 | 24.7534 | 20.8978 | 22.5809 | 29.3515 | 39.3955 | 50.0216 | 58.3826 | 62.2381 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 378.1859 | 382.1103 | 372.2209 | 351.1677 | 324.5918 | 299.6142 | 282.9277 | 279.0033 | 288.8926 | 309.9458 | 336.5217 | 361.4993 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | (71) |
| Water heating gains (Table 5) | 128.8448 | 126.4411 | 119.9489 | 107.1598 | 96.5009 | 90.0474 | 84.7748 | 92.5310 | 101.9351 | 113.4610 | 122.8925 | 126.4512 | (72) |
| Total internal gains | 679.0859 | 673.8360 | 647.4104 | 602.9420 | 557.3462 | 522.0596 | 501.7834 | 512.3859 | 541.7232 | 584.9285 | 629.2969 | 661.6887 | (73) |

6. Solar gains

| | | | | | | | | | | | | |
|-------------|----------|------------|---------------|---------------|----------|---------------|----------|----------|----------|----------|----------|---------------|
| [Jan] | Area | Solar flux | g | FF | Access | Gains | | | | | | |
| | m2 | Table 6a | Specific data | Specific data | factor | W | | | | | | |
| | | W/m2 | or Table 6b | or Table 6c | Table 6d | | | | | | | |
| North | 5.8100 | 10.6334 | 0.6300 | 0.7000 | 0.7700 | 18.8808 (74) | | | | | | |
| East | 0.7200 | 19.6403 | 0.6300 | 0.7000 | 0.7700 | 4.3217 (76) | | | | | | |
| South | 7.2500 | 46.7521 | 0.6300 | 0.7000 | 0.7700 | 103.5883 (78) | | | | | | |
| Solar gains | 126.7907 | 214.1871 | 291.3402 | 363.0345 | 412.0704 | 412.4374 | 396.1706 | 358.4453 | 315.6574 | 235.9670 | 151.4679 | 108.8037 (83) |
| Total gains | 805.8766 | 888.0231 | 938.7506 | 965.9766 | 969.4166 | 934.4970 | 897.9540 | 870.8312 | 857.3806 | 820.8955 | 780.7649 | 770.4924 (84) |

7. Mean internal temperature (heating season)

| | | | | | | | | | | | | |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | | | | | | | | | | | | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| tau | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 |
| alpha | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 |
| util living area | 0.9272 | 0.9035 | 0.8676 | 0.8077 | 0.7126 | 0.5752 | 0.4416 | 0.4703 | 0.6420 | 0.8113 | 0.8998 | 0.9349 (86) |
| MIT | 19.3373 | 19.5555 | 19.8766 | 20.2571 | 20.6050 | 20.8483 | 20.9479 | 20.9358 | 20.7803 | 20.3525 | 19.7719 | 19.2667 (87) |
| Th 2 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 (88) |
| util rest of house | 0.9180 | 0.8916 | 0.8508 | 0.7821 | 0.6722 | 0.5131 | 0.3610 | 0.3901 | 0.5841 | 0.7815 | 0.8855 | 0.9265 (89) |
| MIT 2 | 17.8890 | 18.1995 | 18.6553 | 19.1870 | 19.6559 | 19.9587 | 20.0641 | 20.0535 | 19.8829 | 19.3275 | 18.5148 | 17.7884 (90) |
| Living area fraction | 18.1426 | 18.4369 | 18.8691 | 19.3743 | 19.8220 | 20.1144 | 20.2188 | 20.2080 | 20.0400 | 19.5069 | 18.7348 | 18.0472 (92) |
| MIT | 17.9926 | 18.2869 | 18.7191 | 19.2243 | 19.6720 | 19.9644 | 20.0688 | 20.0580 | 19.8900 | 19.3569 | 18.5848 | 17.8972 (93) |
| Temperature adjustment | | | | | | | | | | | | -0.1500 |
| adjusted MIT | | | | | | | | | | | | 17.8476 |

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------------|-------|
| Utilisation | 0.8900 | 0.8614 | 0.8198 | 0.7533 | 0.6509 | 0.5031 | 0.3581 | 0.3862 | 0.5694 | 0.7526 | 0.8549 | 0.8995 | (94) |
| Useful gains | 717.1919 | 764.9286 | 769.5633 | 727.6696 | 630.9873 | 470.1000 | 321.5717 | 336.2810 | 488.1574 | 617.8070 | 667.5030 | 693.0750 | (95) |
| Ext temp. | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 | (96) |
| Heat loss rate W | 1317.8556 | 1288.4355 | 1176.0417 | 993.6748 | 767.2765 | 516.3051 | 333.8588 | 352.0655 | 557.2655 | 842.8196 | 1105.3724 | 1318.3010 | (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | (97a) |
| Space heating kWh | 446.8938 | 351.7966 | 302.4199 | 191.5238 | 101.3992 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 167.4093 | 315.2659 | 465.1681 | (98) |
| Space heating | | | | | | | | | | | | 2341.8765 | (98) |
| Space heating per m2 | | | | | | | | | | | | 23.8480 | (99) |
| | | | | | | | | | | | | (98) / (4) = | |

8c. Space cooling requirement

Not applicable

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 | (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 | (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 91.2000 | (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 | (208) |
| Space heating requirement | 446.8938 | 351.7966 | 302.4199 | 191.5238 | 101.3992 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 167.4093 | 315.2659 | 465.1681 | (98) | |
| Space heating efficiency (main heating system 1) | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 91.2000 | 91.2000 | 91.2000 | (210) | |
| Space heating fuel (main heating system) | 490.0151 | 385.7419 | 331.6008 | 210.0041 | 111.1833 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 183.5628 | 345.6863 | 510.0528 | (211) | |
| Water heating requirement | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (215) | |
| Water heating requirement | 164.7398 | 126.4982 | 106.3538 | 62.3803 | 35.2658 | 18.4758 | 13.2141 | 42.3195 | 70.7369 | 112.5423 | 143.8769 | 163.8193 | (64) | |
| Efficiency of water heater (217)m | 88.0478 | 88.1028 | 88.1515 | 88.3159 | 88.1756 | 80.5000 | 80.5000 | 80.5000 | 80.5000 | 86.5740 | 87.5533 | 88.1484 | (216) | |
| Fuel for water heating, kWh/month | 187.1026 | 143.5802 | 120.6489 | 70.6331 | 39.9950 | 22.9513 | 16.4151 | 52.5708 | 87.8720 | 129.9956 | 164.3307 | 185.8449 | (219) | |
| Water heating fuel used | | | | | | | | | | | | 1221.9402 | (219) | |
| Annual totals kWh/year | | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 2567.8471 | (211) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 | (215) |
| Electricity for pumps and fans: | | | | | | | | | | | | | | |
| (MEV)Decentralised, Database: total watage = 8.7725, total flow = 37.0000, SFP = 0.2371) | | | | | | | | | | | | | | |
| mechanical ventilation fans (SFP = 0.2371) | | | | | | | | | | | | | 72.4324 | (230a) |
| central heating pump | | | | | | | | | | | | | 30.0000 | (230c) |
| main heating flue fan | | | | | | | | | | | | | 45.0000 | (230e) |
| pump for solar water heating | | | | | | | | | | | | | 50.0000 | (230g) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 197.4324 | (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 427.7687 | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 1.01 * 1080 * 1.00) = | | | | | | | | | | | | | -872.2559 | (233) |
| Total delivered energy for all uses | | | | | | | | | | | | | 3542.7325 | (238) |

10a. Fuel costs - using Table 12 prices

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year | |
|---------------------------------------|---------------|------------------|------------------|-------|
| Space heating - main system 1 | 2567.8471 | 7.6000 | 195.1564 | (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (242) |
| Water heating (other fuel) | 1221.9402 | 7.6000 | 92.8675 | (247) |
| Mechanical ventilation fans | 72.4324 | 13.1900 | 9.5538 | (249) |
| Pumps and fans for heating | 75.0000 | 13.1900 | 9.8925 | (249) |
| Pump for solar water heating | 50.0000 | 13.1900 | 6.5950 | (249) |
| Energy for lighting | 427.7687 | 13.1900 | 56.4227 | (250) |
| Additional standing charges | | | 70.0000 | (251) |
| Energy saving/generation technologies | | | | |
| PV Unit | -872.2559 | 13.1900 | -115.0506 | (252) |
| Total energy cost | | | 325.4373 | (255) |

11a. SAP rating - Individual heating systems

| | | | |
|----------------------------------|----------------------------------|---------|-------|
| Energy cost deflator (Table 12): | | 0.4200 | (256) |
| Energy cost factor (ECF) | [(255) x (256)] / [(4) + 45.0] = | 0.9545 | (257) |
| SAP value | | 86.6848 | |
| SAP rating (Section 12) | | 87 | (258) |
| SAP band | | B | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1 | 2567.8471 | 0.2410 | 618.8511 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1221.9402 | 0.2410 | 294.4876 (264) |
| Space and water heating | | | 913.3387 (265) |
| Pumps and fans | 197.4324 | 0.5190 | 102.4674 (267) |
| Energy for lighting | 427.7687 | 0.5190 | 222.0120 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -872.2559 | 0.5190 | -452.7008 (269) |
| Total kg/year | | | 785.1173 (272) |
| CO2 emissions per m2 | | | 8.0000 (273) |
| EI value | | | 92.6532 |
| EI rating | | | 93 (274) |
| EI band | | | A |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

| | Area (m2) | Storey height (m) | Volume (m3) |
|--|--------------|-------------------|--|
| Ground floor | 49.1000 (1b) | 2.4200 (2b) | 118.8220 (1b) - (3b) |
| First floor | 49.1000 (1c) | 2.6800 (2c) | 131.5880 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 98.2000 | | (4) |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 250.4100 (5) |

2. Ventilation rate

| | main heating | secondary heating | other | total | m3 per hour | | | | | | | |
|---|--------------|-------------------|-----------------------------|----------------|-------------|------------|------------|------------|------------|------------|------------|-----------------|
| Number of chimneys | 0 | 0 | 0 | 0 * 40 = | 0.0000 (6a) | | | | | | | |
| Number of open flues | 0 | 0 | 0 | 0 * 20 = | 0.0000 (6b) | | | | | | | |
| Number of intermittent fans | | | | 0 * 10 = | 0.0000 (7a) | | | | | | | |
| Number of passive vents | | | | 0 * 10 = | 0.0000 (7b) | | | | | | | |
| Number of flueless gas fires | | | | 0 * 40 = | 0.0000 (7c) | | | | | | | |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | | | | 0.0000 / (5) = | 0.0000 (8) | | | | | | | |
| Pressure test | | | | | Yes | | | | | | | |
| Measured/design AP50 | | | | | 5.0000 | | | | | | | |
| Infiltration rate | | | | | 0.2500 (18) | | | | | | | |
| Number of sides sheltered | | | | | 3 (19) | | | | | | | |
| Shelter factor | | | (20) = 1 - [0.075 x (19)] = | | 0.7750 (20) | | | | | | | |
| Infiltration rate adjusted to include shelter factor | | | (21) = (18) x (20) = | | 0.1938 (21) | | | | | | | |
| Wind speed | Jan 5.7000 | Feb 5.8000 | Mar 5.7000 | Apr 5.0000 | May 4.6000 | Jun 4.4000 | Jul 4.0000 | Aug 4.1000 | Sep 4.6000 | Oct 5.2000 | Nov 5.3000 | Dec 5.1000 (22) |
| Wind factor | 1.4250 | 1.4500 | 1.4250 | 1.2500 | 1.1500 | 1.1000 | 1.0000 | 1.0250 | 1.1500 | 1.3000 | 1.3250 | 1.2750 (22a) |
| Adj infilt rate | 0.2761 | 0.2809 | 0.2761 | 0.2422 | 0.2228 | 0.2131 | 0.1938 | 0.1986 | 0.2228 | 0.2519 | 0.2567 | 0.2470 (22b) |
| Mechanical extract ventilation - decentralised | | | | | | | | | | | | 0.5000 (23a) |
| If mechanical ventilation: | | | | | | | | | | | | 0.5000 (23a) |
| Effective ac | 0.5261 | 0.5309 | 0.5261 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5019 | 0.5067 | 0.5000 (25) |

3. Heat losses and heat loss parameter

| Element | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K | | | | | |
|---|-------------|-------------|-------------|---------------|----------------------|----------------|---------------|-------------|-------------|-------------|-------------|------------------|
| Entrance Door | | | 2.1000 | 1.4000 | 2.9400 | | (26) | | | | | |
| Windows/ Patios (Uw = 1.40) | | | 13.7800 | 1.3258 | 18.2689 | | (27) | | | | | |
| Insulated slab 3SV 98 | | | 49.1000 | 0.1200 | 5.8920 | | (28a) | | | | | |
| Render/ Blk T/Frame | 96.5000 | 12.7000 | 83.8000 | 0.1600 | 13.4080 | | (29a) | | | | | |
| Feature Stone | 8.4100 | 3.1800 | 5.2300 | 0.1600 | 0.8368 | | (29a) | | | | | |
| Horizontal | 49.1000 | | 49.1000 | 0.1000 | 4.9100 | | (30) | | | | | |
| Total net area of external elements Aum(A, m2) | | | 203.1100 | | | | (31) | | | | | |
| Fabric heat loss, W/K = Sum (A x U) | | | | | (26)...(30) + (32) = | 46.2557 | (33) | | | | | |
| Party Wall 1 | | | 45.9000 | 0.0000 | 0.0000 | | (32) | | | | | |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K | | | | | | | 100.0000 (35) | | | | | |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) | | | | | | | 8.6728 (36) | | | | | |
| Total fabric heat loss | | | | | | (33) + (36) = | 54.9285 (37) | | | | | |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) | | | | | | | | | | | | |
| (38)m | Jan 43.4739 | Feb 43.8742 | Mar 43.4739 | Apr 41.3177 | May 41.3177 | Jun 41.3177 | Jul 41.3177 | Aug 41.3177 | Sep 41.3177 | Oct 41.4726 | Nov 41.8729 | Dec 41.3177 (38) |
| Heat transfer coeff | 98.4024 | 98.8027 | 98.4024 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.2461 | 96.4011 | 96.8013 | 96.2461 (39) |
| Average = Sum(39)m / 12 = | | | | | | | | | | | | 96.8777 (39) |
| HLP | Jan 1.0021 | Feb 1.0061 | Mar 1.0021 | Apr 0.9801 | May 0.9801 | Jun 0.9801 | Jul 0.9801 | Aug 0.9801 | Sep 0.9801 | Oct 0.9817 | Nov 0.9858 | Dec 0.9801 (40) |
| HLP (average) | | | | | | | | | | | | 0.9865 (40) |
| Days in month | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 (41) |

4. Water heating energy requirements (kWh/year)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy | | | | | | | | | | | | 2.7222 (42) |
| Average daily hot water use (litres/day) | | | | | | | | | | | | 104.0557 (43) |
| Daily hot water use | 114.4612 | 110.2990 | 106.1368 | 101.9745 | 97.8123 | 93.6501 | 93.6501 | 97.8123 | 101.9745 | 106.1368 | 110.2990 | 114.4612 (44) |
| Energy conte | 169.7427 | 148.4580 | 153.1954 | 133.5595 | 128.1535 | 110.5867 | 102.4748 | 117.5914 | 118.9958 | 138.6781 | 151.3780 | 164.3867 (45) |
| Energy content (annual) | | | | | | | | | | | | Total = Sum(45)m = 1637.2006 (45) |
| Distribution loss (46)m = 0.15 x (45)m | | | | | | | | | | | | |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

| | | | | | | | | | | | | |
|---|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-------------------|
| Water storage loss: | 25.4614 | 22.2687 | 22.9793 | 20.0339 | 19.2230 | 16.5880 | 15.3712 | 17.6387 | 17.8494 | 20.8017 | 22.7067 | 24.6580 (46) |
| Store volume | | | | | | | | | | | | 250.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): | | | | | | | | | | | | 2.2200 (48) |
| Temperature factor from Table 2b | | | | | | | | | | | | 0.5400 (49) |
| Enter (49) or (54) in (55) | | | | | | | | | | | | 1.1988 (55) |
| Total storage loss | 37.1628 | 33.5664 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 | 37.1628 | 35.9640 | 37.1628 | 35.9640 | 37.1628 (56) |
| If cylinder contains dedicated solar storage | 26.0140 | 23.4965 | 26.0140 | 25.1748 | 26.0140 | 25.1748 | 26.0140 | 26.0140 | 25.1748 | 26.0140 | 25.1748 | 26.0140 (57) |
| Primary loss | 23.2624 | 21.0112 | 21.8667 | 15.7584 | 10.4681 | 9.9053 | 10.2355 | 11.1660 | 17.1091 | 21.8667 | 22.5120 | 23.2624 (59) |
| Total heat required for water heating calculated for each month | 219.0190 | 192.9657 | 201.0760 | 174.4927 | 164.6355 | 145.6668 | 138.7243 | 154.7713 | 161.2797 | 186.5587 | 199.0648 | 213.6631 (62) |
| Aperture area of solar collector | | | | | | | | | | | | 3.0000 (H1) |
| Zero-loss collector efficiency | | | | | | | | | | | | 0.7000 (H2) |
| Collector heat loss coefficient | | | | | | | | | | | | 1.8000 (H3) |
| Collector 2nd order heat loss coefficient | | | | | | | | | | | | 0.0050 (H3a) |
| Collector effective heat loss coefficient | | | | | | | | | | | | 1.8063 (H3b) |
| Collector performance ratio | | | | | | | | | | | | 2.5804 (H4) |
| Annual solar radiation per m2 | | | | | | | | | | | | 1017.1843 (H5) |
| Overshading factor | | | | | | | | | | | | 0.8000 (H6) |
| Solar energy available | | | | | | | | | | | | 1708.8697 (H7) |
| Adjustment factor for showers | | | | | | | | | | | | 1.0000 (H7a) |
| Solar-to-load ratio | | | | | | | | | | | | 1.0438 (H8) |
| Utilisation factor | | | | | | | | | | | | 0.6164 (H9) |
| Collector performance factor | | | | | | | | | | | | 0.8793 (H10) |
| Dedicated solar storage volume | | | | | | | | | | | | 75.0000 (H11) |
| Effective solar volume | | | | | | | | | | | | 127.5000 (H13) |
| Daily hot water demand | | | | | | | | | | | | 104.0557 (H14) |
| Volume ratio Veff/V | | | | | | | | | | | | 1.2253 (H15) |
| Solar storage volume factor | | | | | | | | | | | | 1.0000 (H16) |
| Solar input | | | | | | | | | | | | -926.1469 (H17) |
| Solar input | -22.0897 | -41.8868 | -78.7143 | -107.2380 | -139.1014 | -126.6880 | -124.7798 | -107.5980 | -81.6017 | -52.4341 | -27.1407 | -16.8744 (63) |
| FGHRS | -28.1432 | -21.7019 | -16.9582 | -7.2205 | 0.0000 | 0.0000 | 0.0000 | -2.9197 | -4.9213 | -17.9289 | -23.8876 | -28.2984 eq. (G6) |
| Output from w/h | 168.7861 | 129.3770 | 105.4035 | 60.0342 | 25.5341 | 18.9788 | 13.9445 | 44.2536 | 74.7567 | 116.1957 | 148.0364 | 168.4903 (64) |
| Heat gains from water heating, kWh/month | 95.8605 | 84.9684 | 89.2420 | 77.1551 | 71.7967 | 64.8341 | 63.0724 | 68.8431 | 73.3932 | 84.4150 | 88.4826 | 94.0797 (65) |
| Total per year (kWh/year) = Sum(64)m = 1073.7908 (64) | | | | | | | | | | | | |

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

| Metabolic gains (Table 5), Watts | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (66)m |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| (66)m | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 | 163.3336 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | 60.5551 | 53.7845 | 43.7405 | 33.1144 | 24.7534 | 20.8978 | 22.5809 | 29.3515 | 39.3955 | 50.0216 | 58.3826 | 62.2381 | 62.2381 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 378.1859 | 382.1103 | 372.2209 | 351.1677 | 324.5918 | 299.6142 | 282.9277 | 279.0033 | 288.8926 | 309.9458 | 336.5217 | 361.4993 | 361.4993 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 | 54.0556 (69) |
| Pumps, fans | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 | 3.0000 (70) |
| Losses e.g. evaporation (negative values) (Table 5) | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 | -108.8890 (71) |
| Water heating gains (Table 5) | 128.8448 | 126.4411 | 119.9489 | 107.1598 | 96.5009 | 90.0474 | 84.7748 | 92.5310 | 101.9351 | 113.4610 | 122.8925 | 126.4512 | 126.4512 (72) |
| Total internal gains | 679.0859 | 673.8360 | 647.4104 | 602.9420 | 557.3462 | 522.0596 | 501.7834 | 512.3859 | 541.7232 | 584.9285 | 629.2969 | 661.6887 | 661.6887 (73) |

6. Solar gains

| [Jan] | Area m2 | Solar flux Table 6a W/m2 | Specific data g or Table 6b | FF Specific data or Table 6c | Access factor Table 6d | Gains W | | | | | | | |
|-------------|----------|--------------------------|-----------------------------|------------------------------|------------------------|--------------|----------|----------|----------|----------|----------|----------|---------------|
| North | 5.8100 | 8.2005 | 0.6300 | 0.7000 | 0.7700 | 14.5609 (74) | | | | | | | |
| East | 0.7200 | 14.7869 | 0.6300 | 0.7000 | 0.7700 | 3.2537 (76) | | | | | | | |
| South | 7.2500 | 38.1750 | 0.6300 | 0.7000 | 0.7700 | 84.5841 (78) | | | | | | | |
| Solar gains | 102.3987 | 197.0139 | 295.0105 | 369.6645 | 435.3197 | 401.3935 | 385.7586 | 347.9508 | 300.4342 | 212.5420 | 126.8290 | 80.1289 | 80.1289 (83) |
| Total gains | 781.4846 | 870.8499 | 942.4209 | 972.6065 | 992.6659 | 923.4531 | 887.5420 | 860.3366 | 842.1574 | 797.4705 | 756.1259 | 741.8176 | 741.8176 (84) |

7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Thl (C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | (85) |
|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) | 27.7206 | 27.6083 | 27.7206 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.3417 | 28.2961 | 28.1791 | 28.3417 | 28.3417 (85) |
| tau | 2.8480 | 2.8406 | 2.8480 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8894 | 2.8864 | 2.8786 | 2.8894 | 2.8894 (86) |
| util living area | 0.9411 | 0.9229 | 0.8919 | 0.8471 | 0.7877 | 0.7100 | 0.6337 | 0.6523 | 0.7533 | 0.8654 | 0.9237 | 0.9495 | 0.9495 (86) |
| MIT | 19.0703 | 19.2470 | 19.5927 | 20.0065 | 20.3347 | 20.6301 | 20.7849 | 20.7639 | 20.5518 | 20.0611 | 19.4902 | 18.9939 | 18.9939 (87) |
| Th 2 | 20.0816 | 20.0782 | 20.0816 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0999 | 20.0986 | 20.0952 | 20.0999 | 20.0999 (88) |
| util rest of house | 0.9337 | 0.9135 | 0.8787 | 0.8278 | 0.7597 | 0.6670 | 0.5766 | 0.5963 | 0.7136 | 0.8449 | 0.9132 | 0.9432 | 0.9432 (89) |
| MIT 2 | 17.4930 | 17.7434 | 18.2393 | 18.8370 | 19.2922 | 19.6911 | 19.8867 | 19.8630 | 19.5941 | 18.9232 | 18.1090 | 17.3940 | 17.3940 (90) |
| Living area fraction | 17.7691 | 18.0066 | 18.4763 | 19.0417 | 19.4747 | 19.8555 | 20.0440 | 20.0207 | 19.7618 | 19.1224 | 18.3508 | 17.6740 | 17.6740 (92) |
| MIT | 17.6191 | 17.8566 | 18.3263 | 18.8917 | 19.3247 | 19.7055 | 19.8940 | 19.8707 | 19.6118 | 18.9724 | 18.2008 | 17.5240 | 17.5240 (93) |
| Temperature adjustment | | | | | | | | | | | | | -0.1500 |
| adjusted MIT | | | | | | | | | | | | | 17.5240 (93) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|----------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|--------------|-------|
| Utilisation | 0.9073 | 0.8844 | 0.8474 | 0.7971 | 0.7322 | 0.6461 | 0.5624 | 0.5807 | 0.6891 | 0.8138 | 0.8845 | 0.9190 | (94) |
| Useful gains | 709.0429 | 770.1435 | 798.6015 | 775.2965 | 726.8702 | 596.6270 | 499.1710 | 499.5698 | 580.3421 | 648.9675 | 668.7559 | 681.7066 | (95) |
| Ext temp. | 3.3000 | 3.6000 | 5.0000 | 7.1000 | 9.3000 | 12.2000 | 14.0000 | 13.9000 | 12.0000 | 8.8000 | 5.7000 | 2.9000 | (96) |
| Heat loss rate W | 1409.0358 | 1408.5911 | 1311.3356 | 1134.9087 | 964.8398 | 722.3731 | 567.2704 | 574.6562 | 732.6023 | 980.6260 | 1210.0896 | 1407.5080 | (97) |
| Month fracti | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | (97a) |
| Space heating kWh | 520.7947 | 429.0368 | 381.4742 | 258.9208 | 177.0494 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 246.7539 | 389.7603 | 539.9962 | (98) |
| Space heating | | | | | | | | | | | | 2943.7864 | (98) |
| Space heating per m2 | | | | | | | | | | | | 29.9775 | (99) |
| | | | | | | | | | | | | (98) / (4) = | |

8c. Space cooling requirement

Not applicable

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|----------|----------|-----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11) | | | | | | | | | | | | | 0.0000 | (201) |
| Fraction of space heat from main system(s) | | | | | | | | | | | | | 1.0000 | (202) |
| Efficiency of main space heating system 1 (in %) | | | | | | | | | | | | | 91.2000 | (206) |
| Efficiency of secondary/supplementary heating system, % | | | | | | | | | | | | | 0.0000 | (208) |
| Space heating requirement | 520.7947 | 429.0368 | 381.4742 | 258.9208 | 177.0494 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 246.7539 | 389.7603 | 539.9962 | (98) | |
| Space heating efficiency (main heating system 1) | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 91.2000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 91.2000 | 91.2000 | 91.2000 | (210) | |
| Space heating fuel (main heating system) | 571.0468 | 470.4351 | 418.2831 | 283.9044 | 194.1332 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 270.5635 | 427.3687 | 592.1011 | (211) | |
| Water heating requirement | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | (215) | |
| Water heating requirement | 168.7861 | 129.3770 | 105.4035 | 60.0342 | 25.5341 | 18.9788 | 13.9445 | 44.2536 | 74.7567 | 116.1957 | 148.0364 | 168.4903 | (64) | |
| Efficiency of water heater (217)m | 88.3264 | 88.4753 | 88.6491 | 88.9740 | 89.6973 | 80.5000 | 80.5000 | 80.5000 | 80.5000 | 87.4776 | 87.9810 | 88.4055 | (216) | |
| Fuel for water heating, kWh/month | 191.0937 | 146.2294 | 118.8997 | 67.4738 | 28.4670 | 23.5761 | 17.3223 | 54.9734 | 92.8655 | 132.8292 | 168.2596 | 190.5881 | (219) | |
| Water heating fuel used | | | | | | | | | | | | 1232.5778 | (219) | |
| Annual totals kWh/year | | | | | | | | | | | | | | |
| Space heating fuel - main system | | | | | | | | | | | | | 3227.8360 | (211) |
| Space heating fuel - secondary | | | | | | | | | | | | | 0.0000 | (215) |
| Electricity for pumps and fans: | | | | | | | | | | | | | | |
| (MEV)Decentralised, Database: total watage = 8.7725, total flow = 37.0000, SFP = 0.2371) | | | | | | | | | | | | | | |
| mechanical ventilation fans (SFP = 0.2371) | | | | | | | | | | | | | 72.4324 | (230a) |
| central heating pump | | | | | | | | | | | | | 30.0000 | (230c) |
| main heating flue fan | | | | | | | | | | | | | 45.0000 | (230e) |
| pump for solar water heating | | | | | | | | | | | | | 50.0000 | (230g) |
| Total electricity for the above, kWh/year | | | | | | | | | | | | | 197.4324 | (231) |
| Electricity for lighting (calculated in Appendix L) | | | | | | | | | | | | | 427.7687 | (232) |
| Energy saving/generation technologies (Appendices M ,N and Q) | | | | | | | | | | | | | | |
| PV Unit 0 (0.80 * 1.01 * 1017 * 1.00) = | | | | | | | | | | | | | -821.8849 | (233) |
| Total delivered energy for all uses | | | | | | | | | | | | | 4263.7300 | (238) |

10a. Fuel costs - using BEDF prices (510)

| | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year | |
|---------------------------------------|---------------|------------------|------------------|-------|
| Space heating - main system 1 | 3227.8360 | 6.9800 | 225.3030 | (240) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (242) |
| Water heating (other fuel) | 1232.5778 | 6.9800 | 86.0339 | (247) |
| Mechanical ventilation fans | 72.4324 | 22.5500 | 16.3335 | (249) |
| Pumps and fans for heating | 75.0000 | 22.5500 | 16.9125 | (249) |
| Pump for solar water heating | 50.0000 | 22.5500 | 11.2750 | (249) |
| Energy for lighting | 427.7687 | 22.5500 | 96.4618 | (250) |
| Additional standing charges | | | 63.0000 | (251) |
| Energy saving/generation technologies | | | | |
| PV Unit | -821.8849 | 22.5500 | -185.3351 | (252) |
| Total energy cost | | | 329.9847 | (255) |

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

| | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|-------------------------------|-----------------|----------------------------|-----------------------|-------|
| Space heating - main system 1 | 3227.8360 | 0.2410 | 777.9085 | (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 | (263) |
| Water heating (other fuel) | 1232.5778 | 0.2410 | 297.0512 | (264) |
| Space and water heating | | | 1074.9597 | (265) |

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

| | | | |
|---------------------------------------|-----------|--------|-----------------|
| Pumps and fans | 197.4324 | 0.5190 | 102.4674 (267) |
| Energy for lighting | 427.7687 | 0.5190 | 222.0120 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -821.8849 | 0.5190 | -426.5583 (269) |
| Total kg/year | | | 972.8808 (272) |

 13a. Primary energy - Individual heating systems including micro-CHP

| | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1 | 3227.8360 | 1.0900 | 3518.3412 (261) |
| Space heating - secondary | 0.0000 | 0.0000 | 0.0000 (263) |
| Water heating (other fuel) | 1232.5778 | 1.0900 | 1343.5097 (264) |
| Space and water heating | | | 4861.8510 (265) |
| Pumps and fans | 197.4324 | 3.0700 | 606.1176 (267) |
| Energy for lighting | 427.7687 | 3.0700 | 1313.2500 (268) |
| Energy saving/generation technologies | | | |
| PV Unit | -821.8849 | 3.0700 | -2523.1868 (269) |
| Primary energy kWh/year | | | 4258.0318 (272) |
| Primary energy kWh/m2/year | | | 43.3608 (273) |

U-VALUE CALCULATOR REPORT

| | | | | |
|----------------------|---|---------------|----------------|------------|
| Property Reference | ajc mortlich 73 | | Issued on Date | 31/01/2023 |
| Assessment Reference | tar rd 73 | Prop Type Ref | | |
| Project | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | | |
| Calculation Type | New Build (As Designed) | | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO ₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | Assessor ID | 1910-0001 |
| Client | | | |

Building Elements

Roof 000001

Roof Type: Pitched Roof, insulated flat ceiling

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|
| Ext surface | | | | 0.0400 | |
| Layer 1 | Earthwool Loft Roll 40 over ties | | | | |
| | Main construction | 200 | 0.0400 | 5.0000 | 100.00 |
| | Corrections - Air Gap: Level 0, Fasteners: None or plastic | | | | |
| Layer 2 | Earthwool Loft Roll 40 in ties | | | | |
| | Main construction | 200 | 0.0400 | 5.0000 | 92.17 |
| | Main construction | 200 | 0.1300 | 1.5385 | 7.83 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | |
| Layer 3 | Plasterboard, standard | | | | |
| | Main construction | 12.5 | 0.2100 | 0.0595 | 100.00 |
| Int surface | | | | 0.1000 | |

Total resistance: Upper limit = 9.805 m² K/W Lower limit = 9.450 m² K/W Average = 9.628 m² K/W
 Total correction = 0.0019 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 413 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

| | | | | |
|----------------------|---|---------------|----------------|------------|
| Property Reference | ajc mortlich 73 | | Issued on Date | 31/01/2023 |
| Assessment Reference | tar rd 73 | Prop Type Ref | | |
| Project | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | | |
| Calculation Type | New Build (As Designed) | | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO ₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | Assessor ID | 1910-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|--|
| Client | |
|--------|--|

Building Elements

Wall Render Block T/Frame

Wall Type: Standard Wall

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|
| Ext surface | | | | 0.0400 | |
| Layer 1 | Render - Cement and Sand | | | | |
| | Main construction | 20 | 1.0000 | 0.0200 | 100.00 |
| Layer 2 | Blockwork, dense | | | | |
| | Main construction | 100 | 1.5900 | 0.0629 | 100.00 |
| Layer 3 | Low E perp vented cavity | | | | |
| | Main construction | 50 | 0.0649 | 0.7700 | 100.00 |
| Layer 4 | Reflective breather membrane | | | | |
| | Main construction | 0.5 | 0.0000 | 0.0000 | 100.00 |
| Layer 5 | Orientated Strand Board | | | | |
| | Main construction | 9 | 0.1300 | 0.0692 | 100.00 |
| Layer 6 | Earthwool Frametherm Roll 35 in T/Frame | | | | |
| | Main construction | 140 | 0.0350 | 4.0000 | 85.00 |
| | Main construction | 140 | 0.1300 | 1.0769 | 15.00 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | |
| Layer 7 | PIR over T/Frame | | | | |
| | Main construction | 30 | 0.0220 | 1.3636 | 100.00 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | |
| Layer 8 | Reflective VCL | | | | |
| | Main construction | 0.4 | 0.0000 | 0.0000 | 100.00 |
| Layer 9 | Low E battens cavity | | | | |
| | Main construction | 38 | 0.0494 | 0.7687 | 89.03 |
| | Main construction | 38 | 0.1300 | 0.2923 | 10.97 |
| | Corrections - Cavity Unventilated, Emissivity: Normal | | | | |
| Layer 10 | Plasterboard, standard | | | | |
| | Main construction | 15 | 0.2100 | 0.0714 | 100.00 |
| Int surface | | | | 0.1300 | |

| | | | |
|-------------------|--|---|------------------------------------|
| Total resistance: | Upper limit = 6.572 m ² K/W | Lower limit = 6.022 m ² K/W | Average = 6.297 m ² K/W |
| | Total correction = 0.0025 m ² K/W | U-value (unrounded) = 0.16 W/m ² K | |

U-VALUE CALCULATOR REPORT

Unheated space: None

Total thickness: 403 mm

U-value: 0.16 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

| | | | | |
|----------------------|---|---------------|----------------|------------|
| Property Reference | ajc mortlich 73 | | Issued on Date | 31/01/2023 |
| Assessment Reference | tar rd 73 | Prop Type Ref | | |
| Project | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | | |
| Calculation Type | New Build (As Designed) | | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO ₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | Assessor ID | 1910-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|--|
| Client | |
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Building Elements

Wall Feature stone

Wall Type: Standard Wall

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|
| Ext surface | | | | 0.0400 | |
| Layer 1 | Artificial stone | | | | |
| | Main construction | 100 | 1.3000 | 0.0769 | 100.00 |
| Layer 2 | Low E perp vented cavity | | | | |
| | Main construction | 50 | 0.0649 | 0.7700 | 100.00 |
| Layer 3 | Reflective breather membrane | | | | |
| | Main construction | 0.5 | 0.0000 | 0.0000 | 100.00 |
| Layer 4 | Orientated Strand Board | | | | |
| | Main construction | 9 | 0.1300 | 0.0692 | 100.00 |
| Layer 5 | Earthwool Frametherm Roll 35 in T/Frame | | | | |
| | Main construction | 140 | 0.0350 | 4.0000 | 85.00 |
| | Main construction | 140 | 0.1300 | 1.0769 | 15.00 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | |
| Layer 6 | PIR over T/Frame | | | | |
| | Main construction | 30 | 0.0220 | 1.3636 | 100.00 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | |
| Layer 7 | Relective VCL | | | | |
| | Main construction | 0.3 | 0.0000 | 0.0000 | 100.00 |
| Layer 8 | Low E battens cavity | | | | |
| | Main construction | 38 | 0.0494 | 0.7687 | 89.03 |
| | Main construction | 38 | 0.1300 | 0.2923 | 10.97 |
| | Corrections - Cavity Unventilated, Emissivity: Normal | | | | |
| Layer 9 | Plasterboard, standard | | | | |
| | Main construction | 15 | 0.2100 | 0.0714 | 100.00 |
| Int surface | | | | 0.1300 | |

Total resistance: Upper limit = 6.566 m² K/W Lower limit = 6.016 m² K/W Average = 6.291 m² K/W
 Total correction = 0.0025 m² K/W U-value (unrounded) = 0.16 W/m² K

| | |
|--------------------------------|--|
| Unheated space: | None |
| Total thickness: 383 mm | U-value: 0.16 W/m² K |
| | Kappa: n/a |

U-VALUE CALCULATOR REPORT

| | | | |
|----------------------|---|----------------|------------|
| Property Reference | ajc mortlich 73 | Issued on Date | 31/01/2023 |
| Assessment Reference | tar rd 73 | Prop Type Ref | |
| Project | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | |
| Calculation Type | New Build (As Designed) | | |

| | | | | | |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO ₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |

| | | | |
|------------------|---|-------------|-----------|
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | Assessor ID | 1910-0001 |
|------------------|---|-------------|-----------|

| | |
|--------|--|
| Client | |
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Building Elements

Floor 3sv 98 Slab

Floor Type: Slab On Ground Floor

Area = 49.10 m², Perimeter = 20.57 m, Wall thickness = 379.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: Width D = 150.0 mm, Thickness dn = 25.0 mm, Lambda = 0.022

| Layer | Description | Thickness (mm) | Conductivity (W/m ² K) | Resistance (m ² K/W) | Fraction (%) |
|-------------|--|----------------|-----------------------------------|---------------------------------|--------------|
| Ext surface | | | | 0.0400 | |
| Layer 1 | Sand blinded hardcore | | | | |
| | Main construction | 200 | 2.3000 | 0.0870 | 100.00 |
| Layer 2 | Polythene,1200 gauge | | | | |
| | Main construction | 0.4 | 0.0000 | 0.0000 | 100.00 |
| Layer 3 | PIR floor insulation | | | | |
| | Main construction | 150 | 0.0220 | 6.8182 | 100.00 |
| | Corrections - Air Gap: Level 1, Fasteners: None or plastic | | | | |
| Layer 4 | Concrete, reinforced (1% steel) | | | | |
| | Main construction | 150 | 2.3000 | 0.0652 | 100.00 |
| Int surface | | | | 0.1700 | |

Total resistance: Upper limit = 6.970 m² K/W Lower limit = 6.970 m² K/W Average = 6.970 m² K/W
 Total correction = 0.0096 m² K/W U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 500 mm

U-value: 0.12 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

| | | | | | |
|------------------------------------|---|---------------|----------------|-------------|-----------|
| Property Reference | ajc mortlich 73 | | Issued on Date | 31/01/2023 | |
| Assessment Reference | tar rd 73 | Prop Type Ref | | | |
| Property | 3SV -98, 73, Tarland Road, Phase 4A (3), Aboyne | | | | |
| SAP Rating | 83 B | DER | 11.99 | TER | 13.57 |
| Environmental | 90 B | % DER<TER | 11.64 | | |
| CO ₂ Emissions (t/year) | 1.23 | FEE | 38.58 | TFEE | N/A |
| General Requirements Compliance | Pass | % DFEE<TFEE | N/A | | |
| Assessor Details | Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com | | | Assessor ID | 1910-0001 |
| Client | | | | | |

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

| | | | | | |
|----------------------------|--------------------------|---------------------------------|------------------------------|------------------------------|-----------------------------|
| Orientation | North | | | | |
| Property Tenure | Owner-occupied | | | | |
| Transaction Type | New dwelling | | | | |
| Terrain Type | Suburban | | | | |
| 1.0 Property Type | House, Semi-Detached | | | | |
| 2.0 Number of Storeys | 2 | | | | |
| 3.0 Date Built | 2018 | | | | |
| 4.0 Sheltered Sides | 3 | | | | |
| 5.0 Sunlight/Shade | Average or unknown | | | | |
| 6.0 Measurements | | Heat Loss Perimeter | Internal Floor Area | Average Storey Height | |
| | Ground Floor: | 20.57 m | 49.10 m ² | 2.42 m | |
| | 1st Storey: | 20.57 m | 49.10 m ² | 2.68 m | |
| 7.0 Living Area | 17.19 | m ² | | | |
| 8.0 Thermal Mass Parameter | Simple calculation - Low | | | | |
| Thermal Mass | 100.00 | kJ/m ² K | | | |
| 9.0 External Walls | Description | Type | U-Value (W/m ² K) | Gross Area (m ²) | Nett Area (m ²) |
| | Render/ Blk T/Frame | Timber Frame | 0.16 | 96.50 | 83.80 |
| | Feature Stone | Timber Frame | 0.16 | 8.41 | 5.23 |
| 9.1 Party Walls | Description | Type | Construction | U-Value (W/m ² K) | Area (m ²) |
| | Party Wall 1 | Filled Cavity with Edge Sealing | | 0.00 | 45.90 |
| 10.0 External Roofs | Description | Type | U-Value (W/m ² K) | Gross Area (m ²) | Nett Area (m ²) |
| | Horizontal | External Plane Roof | 0.10 | 49.10 | 49.10 |
| 11.0 Heat Loss Floors | Description | Type | Construction | U-Value (W/m ² K) | Area (m ²) |
| | Insulated slab 3SV 98 | Ground Floor - Solid | | 0.12 | 49.10 |

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

12.0 Opening Types

| Description | Data Source | Type | Glazing | Glazing Gap | Argon Filled | G-value | Frame Type | Frame Factor | U Value (W/m ² K) |
|-----------------|--------------|------------|------------------------|-------------|--------------|---------|------------|--------------|------------------------------|
| Entrance Door | Manufacturer | Solid Door | | | | | | | 1.40 |
| Windows/ Patios | Manufacturer | Window | Double Low-E Soft 0.05 | | | 0.63 | | 0.70 | 1.40 |

13.0 Openings

| Name | Opening Type | Location | Orientation | Curtain Type | Overhang Ratio | Wide Overhang | Width (m) | Height (m) | Count | Area (m ²) | Curtain Closed |
|-------------------|--------------|-------------------------|-------------|--------------|----------------|---------------|-----------|------------|-------|------------------------|----------------|
| Gable glass | Window | [1] Render/ Blk T/Frame | East | None | 0.00 | | | | | 0.72 | |
| Rear Glass | Window | [1] Render/ Blk T/Frame | South | None | 0.00 | | | | | 7.25 | |
| Front door | Solid Door | [2] Feature Stone | North | | | | | | | 2.10 | |
| Front glass stone | Window | [2] Feature Stone | North | None | 0.00 | | | | | 1.08 | |
| Front Glass | Window | [1] Render/ Blk T/Frame | North | None | 0.00 | | | | | 4.73 | |

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

| Source Type | Bridge Type | Length | Psi | Imported |
|-------------------|--|--------|--------|----------|
| Scotland ACD 2015 | E2 Other lintels (including other steel lintels) | 11.05 | 0.037 | No |
| Scotland ACD 2015 | E3 Sill | 8.55 | 0.033 | No |
| Scotland ACD 2015 | E4 Jamb | 25.50 | 0.031 | No |
| Scotland ACD 2015 | E5 Ground floor (normal) | 20.57 | 0.097 | No |
| Scotland ACD 2015 | E6 Intermediate floor within a dwelling | 20.57 | 0.065 | No |
| Scotland ACD 2015 | E10 Eaves (insulation at ceiling level) | 9.57 | 0.043 | No |
| Scotland ACD 2015 | E12 Gable (insulation at ceiling level) | 11.00 | 0.051 | No |
| Scotland ACD 2015 | E16 Corner (normal) | 14.52 | 0.038 | No |
| Scotland ACD 2015 | E17 Corner (inverted – internal area greater than external area) | 4.84 | -0.029 | No |
| Scotland ACD 2015 | E18 Party wall between dwellings | 9.00 | 0.086 | No |
| Scotland ACD 2015 | P1 Party wall - Ground floor | 9.00 | 0.099 | No |
| Scotland ACD 2015 | P4 Party wall - Roof (insulation at ceiling level) | 9.00 | 0.090 | No |

Y-value W/m²K

18.0 Pressure Testing

| | | |
|---------------------------|-----------------------------------|---|
| Designed AP ₅₀ | <input type="text" value="5.00"/> | m ³ /(h.m ²) @ 50 Pa |
| Property Tested ? | <input type="text"/> | |
| As Built AP ₅₀ | <input type="text"/> | m ³ /(h.m ²) @ 50 Pa |

19.0 Mechanical Ventilation

Summer Overheating

| | |
|-----------------------------|--|
| Windows open in hot weather | <input type="text" value="Windows half open"/> |
| Cross ventilation possible | <input type="text" value="No"/> |
| Night Ventilation | <input type="text" value="No"/> |
| Air change rate | <input type="text" value="2.50"/> |

Mechanical Ventilation

| | |
|---------------------------------------|---------------------------------------|
| Mechanical Ventilation System Present | <input type="text" value="Yes"/> |
| Approved Installation | <input type="text" value="Yes"/> |
| Mechanical Ventilation data Type | <input type="text" value="Database"/> |

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

| | |
|---------------------|--|
| Type | Mechanical extract ventilation - decentralised |
| MV Reference Number | 500340 |
| Duct Type | Flexible |

19.1 Mechanical extract ventilation - Decentralised

| SFP | Fan/Room Type | Count |
|------|-------------------------------|-------|
| 0.17 | In Room Fan Kitchen | 1 |
| 0.16 | In Room Fan Other Wet Room | 3 |

20.0 Fans, Open Fireplaces, Flues

| | MHS | SHS | Other | Total |
|------------------------------|-----|-----|-------|-------|
| Number of Chimneys | 0 | | 0 | 0 |
| Number of open flues | 0 | | 0 | 0 |
| Number of intermittent fans | | | | 0 |
| Number of passive vents | | | | 0 |
| Number of flueless gas fires | | | | 0 |

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

| | | |
|---------------------------------|--------|---|
| Total number of light fittings | 16 | |
| Total number of L.E.L. fittings | 16 | |
| Percentage of L.E.L. fittings | 100.00 | % |

External

| | |
|-------------------------|-----|
| External lights fitted | Yes |
| Light and motion sensor | Yes |

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

| | | |
|--------------------|---------------------------------------|---|
| Database | | |
| Description | LPG Condensing system | |
| Percentage of Heat | 100 | % |
| Database Ref. No. | 18746 | |
| Fuel Type | Bulk LPG | |
| Main Heating | BLB | |
| SAP Code | 102 | |
| In Winter | 91.2 | |
| In Summer | 80.5 | |
| Controls | CBI Time and temperature zone control | |
| PCDF Controls | 0 | |
| Delayed Start Stat | Yes | |
| Sap Code | 2110 | |
| Flue Type | Balanced | |
| Fan Assisted Flue | Yes | |
| Is MHS Pumped | Pump in heated space | |
| Heat Emitter | Radiators | |
| Flow Temperature | Normal (> 45°C) | |

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

| | |
|--|-------------------------|
| Community Heating | None |
| 28.0 Water Heating | HWP From main heating 1 |
| Water Heating | Main Heating 1 |
| Flue Gas Heat Recovery System | Yes |
| Waste Water Heat Recovery Instantaneous System 1 | No |
| Waste Water Heat Recovery Instantaneous System 2 | No |
| Waste Water Heat Recovery Storage System | No |
| Solar Panel | No |
| SAP Code | 901 |

28.1 Flue Gas Heat Recovery System

| | |
|-------------|--|
| Database ID | 60091 |
| Brand Model | Baxi, Assure |
| Details | Year: 2021 + current Applicable Fuel: 2 Boiler Types: RCSK Heat Store Volume: 0 PV module: 0 |

29.0 Hot Water Cylinder

| | |
|--------------------------|----------------------------------|
| Hot Water Cylinder | Hot Water Cylinder |
| Cylinder Stat | Yes |
| Cylinder In Heated Space | Yes |
| Independent Time Control | Yes |
| Insulation Type | Measured Loss |
| Cylinder Volume | 250.00 |
| Loss | 2.22 |
| Pipes insulation | Fully insulated primary pipework |

L kWh/day

31.0 Thermal Store

| |
|------|
| None |
|------|

32.0 Photovoltaic Unit

| | | | | |
|---------------------|--------------------|------------------|--------------------|------------------------------|
| One Dwelling | | | | |
| PV Cells kWp | Orientation | Elevation | Overshading | Connected to Dwelling |
| 1.01 | South | 30° | None Or Little | Yes |

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

| | Typical Cost | Typical savings per year | Ratings after improvement | |
|---------------------|-----------------|--------------------------|---------------------------|----------------------|
| | | | SAP rating | Environmental Impact |
| Solar water heating | £4,000 - £6,000 | £71 | B 87 | |