# Asset Energy Calculator Guidance

## Introduction

This section has been produced to give BREEAM In-Use assessors further guidance on the workings of the asset energy calculator so it is clear how any improvements to the asset performance can be reflected in the calculation of the asset energy rating.

## Overview

The first step to generating the BREEAM In-Use International asset energy score is to assess the performance of a number of energy end use components, listed in Table 10.

In order to assess the performance of the end use component, a number of parameters (subcomponents) that have the greatest impact on the end use component score have been determined. The subcomponents contributing to the end use component score are listed in Table 10.

Table 10: Energy end use components and subcomponents

| End use component | Subcomponent |
|---|---|
| Heating | Building Fabric – Thermal Conductance<br>Building Fabric – Air Leakage Rate<br>Ventilation Heat Recovery<br>Efficiency of Heat Generation |
| Cooling | Solar Gains<br>Building Fabric – Air Leakage Rate<br>Efficiency of Cooling Generation |
| Heating Distribution | Efficiency of Heating Distribution |
| Cooling Distribution | Efficiency of Cooling Distribution |
| Lighting | Efficiency of Lighting Installation |
| Ventilation | Fan Efficiency<br>Duct Leakage<br>Air Handling Unit Leakage |
| Hot Water | Efficiency of Heat Generation |

## Subcomponents

The individual subcomponent scores are calculated by comparing actual performance to a benchmark best practice value. The actual performance is determined by answering the relevant questions in the energy category in Part 1.

The paragraphs below give a further explanation about the calculation of the subcomponent scores.

## Heating

Four subcomponents contribute to the heating end use component score: fabric performance, building infiltration rate, efficiency of heat generation and ventilation heat recovery efficiency.

It is possible to make improvements to the heating end use component score by addressing each of these subcomponents and making improvements to:

1. The fabric performance: maximum score awarded for an external wall u-value of less than 0.17 $W/m^2K$
2. The building infiltration rate: maximum score awarded for infiltration of less than $2.5m^3/m^2$ at 50Pa
3. The heat generator efficiency: maximum score awarded for efficiency equivalent to an electric heat pump with a COP of 7
4. The ventilation heat recovery: maximum score awarded for ventilation heat recovery efficiency of 95%

It should be noted that it is not possible to enter a value for ventilation heat recovery directly into the tool. Instead, the tool uses a default value based on the age of the heating system (where applicable).

## Cooling

There are three subcomponents that contribute to the cooling end use component score: solar gain, building infiltration rate and efficiency of cooling generation.

It is possible to make improvements to the cooling end use component score by addressing each of these subcomponents and making improvements to:

1. Glazing area (as a proxy for solar gains): maximum score awarded for glazing area less than 25% of total façade area
2. The building infiltration rate: maximum score awarded for infiltration of less than $2.5m^3/m^2$ at 50Pa
3. The cooling generator efficiency: maximum score awarded for efficiency equivalent to electric chiller with a COP of 7

## Heating distribution

The heating distribution end use component score is a function of the efficiency of the distribution system and the efficiency of the heat emitter.

Fixed efficiencies are assigned for the building in question in response to the user response to questions which ask for these system details.

The maximum score is achieved where there is no heat distribution i.e. ‘local heating’.

## Cooling distribution

The cooling distribution end use component score is a function of the efficiency of the distribution system and the efficiency of the cooling emitter.

Fixed efficiencies are assigned for the building in question in response to the user response to questions which ask for these system details.

The maximum score is achieved where there is no cooling distribution i.e. ‘local cooling’.

## Lighting

The lighting end use component score is a function of both the type of light fittings installed, and the lighting controls.

The lighting score can be improved by upgrading light fittings, or introducing automatic lighting controls where not already installed.

The most efficient lamp types are LED lighting (with special design lighting control system) and T5 fluorescents. The least efficient lamp types are tungsten halogen and incandescent lamps.

Where fluorescent lamps are installed, the score is improved where they are fitted with high frequency ballasts.

The maximum score is achieved where either LED lighting (with special control) or T5 lamps (with high frequency ballasts) are used with automatic controls covering 75% or more of the floor area not accessible to clients or customers.

Where more than one lamp type is installed, the score is calculated on an area weighted basis.

### Ventilation

The ventilation end use component score is a function of three subcomponents: fan efficiency, duct leakage and air handling unit leakage.

The ventilation end use component score can be improved by:

1. Improving fan efficiency: maximum score awarded for a fan efficiency of 1 W/l/s or less
2. Improving air leakage rates (and undertaking necessary testing to demonstrate compliance): maximum score awarded for Class A test results

### Hot water

The hot water end use component score is a function of the type of system and the fuel type used for water generation.

The maximum score is achieved for point of use generation using any fuel type other than electric.

## Subcomponent and End use component scores

Once the individual subcomponent scores have been generated, they are multiplied by a weighting factor, which reflects the influence that the subcomponent has on the overall performance of the respective end use component. All weighted subcomponent scores are then summed to generate the main end use component score.

In order to generate the overall asset energy rating, it is necessary to take account of the influence that each energy end use component has on the total building energy consumption. Therefore, the end use components are weighted, reflecting the importance of the individual end use component in terms of its contribution to the overall energy consumption. The end use component weighting factors vary according to:

a) building type, to reflect different energy end use patterns

b) asset location, to reflect differences in climate and associated heating or cooling demand

The weighting factors would for example reflect the fact that a large proportion of the energy consumption in a retail building would typically be associated with lighting, or that an office in a hot country would expect to use more energy for cooling than the same office in a colder country.

The performance of each end use component is only assessed where that end use is present in the building that is being assessed. If a particular project does not have one or more of the end use components, the available asset energy score is distributed across the other end use components that are present. Table 11 illustrates how the end use component weighting factors for heating, lighting and hot water increase for a naturally ventilated office without cooling, compared to an air conditioned office with mechanical ventilation.

Table 11: End use component weighting factors

| Open Plan Office | End Use Component Weighting | | | | | | |
|---|---|---|---|---|---|---|---|
| Servicing strategy | Heating | Heating Distribution | Cooling | Cooling Distribution | Lighting | Mechanical Ventilation | Hot Water |
| **Cooling & Mechanical Ventilation** | 39.9 | 7.34 | 17.71 | 7.34 | 9.94 | 14.47 | 4.32 |
| **Naturally Ventilated** | 64.41 | 12.09 | 0 | 0 | 16.38 | 0 | 7.12 |

A further adjustment is then applied to the heating, heating distribution, cooling, and cooling distribution benchmarks to account for local climatic conditions.

## Final score

The final score is calculated by adding together the weighted end use component scores. It is now possible to obtain an asset energy rating output when any Part 1 assessment is submitted to the BIU team for an unverified score or certification.

## Primary energy metric

It should be noted that the metric used to assess asset energy performance is primary energy, where 'primary energy' means energy from renewable and non-renewable sources which has not undergone any conversion or transformation process.

## Asset energy calculator inputs

There are 2 levels of user input information that inform the calculation of the asset energy score.

**Level 1:** the user must enter information on the building type, age of the building, and the servicing strategy. The building age is therefore one of the mandatory pieces of information that the user has to provide, along with building type, building services, and servicing strategy – to establish end use component weightings – and the building location – to inform the climate adjustment made to the end use weightings

**Level 2:** the user can enter further information to describe the performance of various systems; user response to these questions is optional.

If the user is unable to answer any questions describing building performance, the tool will use default lookup values for the calculation. These values are based on either:

- the last time the relevant system was replaced, if known, or
- the age of the building

Figure 4 illustrates the above logic and calculation of the asset energy calculation score.

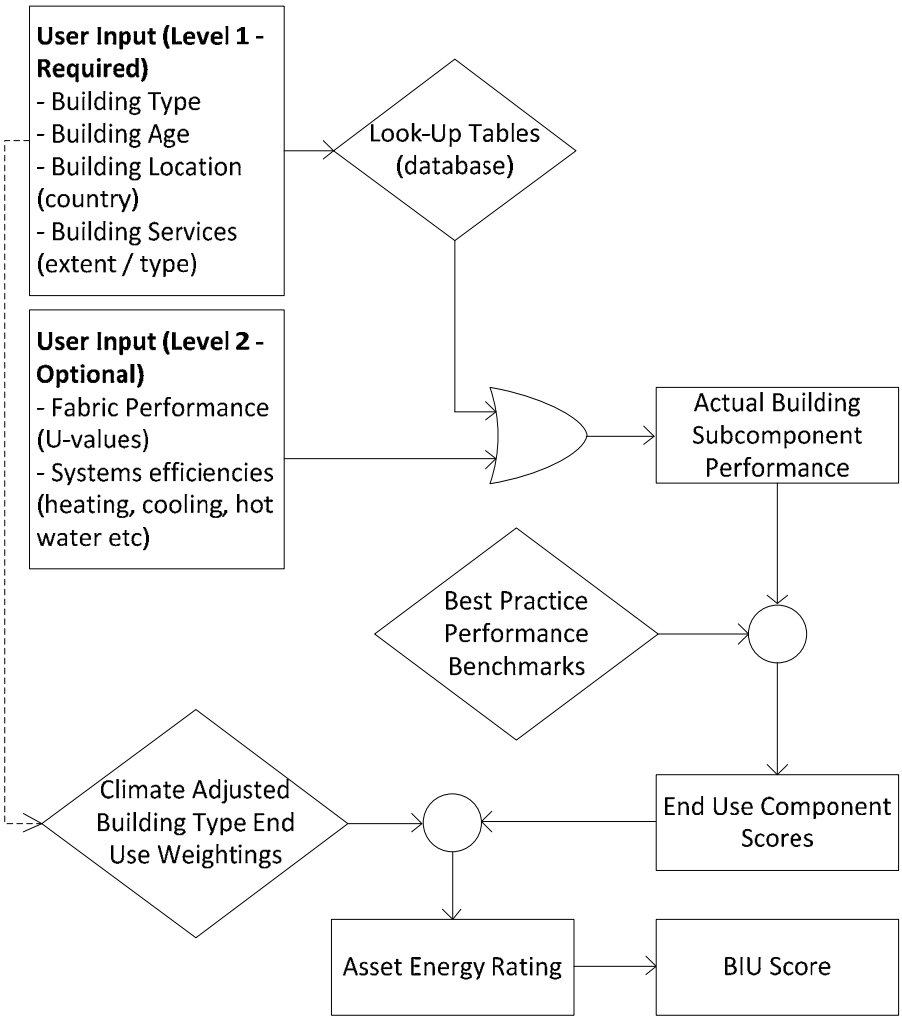


Figure 4: Asset energy calculation flowchart

# Asset Performance ENE 01 – Heating, Ventilation and Air Conditioning (HVAC)

| Number of credits available | Minimum standards | Mandatory question |
|---|---|---|
| Credits are calculated within the Energy Model | No | Yes |

## Question

What building services are present in the asset?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Question not answered |
| - | Heating only |
| - | Heating and cooling |
| - | Cooling only |
| - | None |
| - | Hot water only |
| - | Heating and hot water |
| - | Heating and cooling and hot water |
| - | Cooling and hot water |

## Assessment criteria

1. Building services include any fixed cooling, hot water or heating systems that are installed within the asset. These systems can either service the whole asset or part thereof. Building services include (but are not limited to):
    a) Local hot water
    b) Point of use hot water systems
    c) Boilers
    d) Heat pumps
    e) Chillers
    f) Local heaters
    g) Local split air conditioning systems

h) Fully centralised air conditioning systems

2. Heating/cooling systems can be excluded from the calculation where the heated or cooled area equates to less than 10% of overall floor area.

## Evidence

One of the following is acceptable:

1. Visual inspection and verification through photographic evidence of listed system(s).
2. Extract of Operational & Maintenance (O&M) manuals listing all building services that are present in the building.
3. Installation diagrams.

## Additional information

### Other information

This question must be answered in order to generate the asset energy rating (along with: building type, building age, building location, and building ventilation strategy).

# Asset Performance ENE 02 – Ventilation strategy

| Number of credits available | Minimum standards | Mandatory question |
|---|---|---|
| Credits are calculated within the Energy Model | No | Yes |

## Question

What is the ventilation strategy for the building (Natural or Mechanical)?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | Natural ventilation |
| - | Mechanical ventilation |
| - | Other |

## Assessment criteria

1. Assessors need to confirm that the specified ventilation systems are in use.
2. For the purposes of this BREEAM In-Use issue:

- A mechanically ventilated building is a building with a centralised mechanical ventilation system, or mixed mode building. Typically, a mechanically ventilated building will provide both supply and extract.
- A naturally ventilated building is a building that is designed to be capable of providing fresh air entirely by natural ventilation strategy (with the exception of local mechanical extracts).

3. If both ventilation systems are in use in the building, the selection must be mechanical unless this usage is negligible.

## Evidence

1. Visual inspection and verification through photographic evidence of ventilation system.
2. Extract of O&M manual listing ventilation systems that are present in the building Installation diagrams.

# Additional information

## Other information

This question must be answered in order to generate the asset energy rating (along with: building type, building age, building location, and building services).

# Asset Performance ENE 03 – Heat loss

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

Please provide the design U-Values of the external walls (W/m$^2$K):

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | The design U-value of the walls (W/m²K) |

## Assessment criteria

1. U-Values of the building external walls can be determined through:
   a) A copy of design specifications indicating the design U-value of the assets walls
   b) National building regulation providing an indication of U-value figure
   c) Site investigation e.g. building surveyor with appropriate knowledge of prevalent construction methods; this could be the assessor

**Note:** If the U-values differ between the external walls please enter the average U-value.

**Note:** U-values entered must be between 0.17 and 2 W/m$^2$K. If the U-value is outside of the permitted values, please enter the upper or lower limit as appropriate.

## Evidence

1. Photographic evidence of building wall construction (if possible).
2. Building design plans.
3. Written details of the National building regulations stating the minimum U-value at the time the asset was constructed.
4. Expert report by a building surveyor or equivalent estimating the U-value

## Additional information

### Relevant definitions

**U-value:** is a measure of heat loss in a building element such as a wall, floor or roof that measures the effectiveness of a material as an insulator. The U-value figure of the external walls is used to assess the overall fabric performance of the asset. A lower U-value indicates a higher level of thermal efficiency.

# Asset Performance ENE 04 – Pressure/air leakage test

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the result of the building pressure/air leakage test?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | ≤2.5$m^3$/h/$m^2$@50Pa |
| - | >2.5 to ≤5$m^3$/h/$m^2$@50Pa |
| - | >5 to ≤10$m^3$/h/$m^2$@50Pa |
| - | >10 to ≤15$m^3$/h/$m^2$@50Pa |
| - | >15$m^3$/h/$m^2$@50Pa |
| - | Untested |

## Assessment criteria

1. Assessors should verify:
   a) The results of building pressure/air leakage tests
   b) That testing was conducted by relevant competent persons
2. The appropriate standard for air leakage testing is: ISO 9972:2006/EN 13829:2000 Thermal performance of buildings - Determination of air permeability of buildings - Fan pressurization method
3. Air leakage testing results must be from testing that has, at least, been carried out after construction of the building or when structural changes have been made to the building.

   Their expertise should be broad enough to cover all required technical aspects guaranteeing that the data collected during the test is appropriate and that the results reflect the actual airtightness performance of the building. It can be someone operating as sole trader or employed by public or private enterprise bodies.

## Evidence

1. Copy of results from building pressure and/or air leakage test.
2. Confirmation of competence levels for persons performing testing.

## Additional information

### Relevant definitions

**Air leakage test:** a test which quantifies the air permeability rate of the building envelope. The more airtight the building fabric is the lower the air permeability result will be. To maximise energy efficiency, it is advised that the air permeability result is as low as reasonably practicable.

**Relevant competent person:** An individual achieving all of the following can be considered to be a relevant competent person:

a) Holds a recognised qualification in airtightness testing and measurement.

b) Has relevant experience in air pressure testing at least ten large non-residential buildings within the last five years and a recognised qualification in airtightness testing and measurement.

# Asset Performance ENE 05 – Heating

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the main generation type for space heating?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | Boiler |
| - | Heat pump/reversible chiller |
| - | Direct electricity consumption |
| - | Other onsite heat generation e.g., CHP/Solar thermal |
| - | Heat generated offsite e.g., district heating |
| - | Other |

## Assessment criteria

1. Where there is more than one heat source in the asset, the assessor must clarify and verify that the selected generation type is the main heat source for the asset.
2. If there is more than one boiler the assessor should base the efficiency figure on the average efficiency of the systems. This can be weighted based upon respective system capacities.
3. If there is more than one heat pump the assessor should base the COP figure on the average COP of the systems. This can be weighted based upon respective system capacities.

## Evidence

1. Photographic evidence of listed space heating system.
2. Extract of O&M manuals or copy of manufacturer information of heating systems that are present in the asset.
3. Where there is more than one heat source installed, photographic evidence that the selected generation type is the main heat source.

## Additional information

-

# Asset Performance ENE 06 – Boiler efficiency

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

For boilers, other on-site, offsite, and other generation type heat sources please enter efficiency, if known.

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Boiler efficiency (%) |

## Assessment criteria

1. If there is more than one boiler the assessor should base the efficiency figure on the average efficiency of the two systems. This can be weighted based upon respective system capacities.
2. The question need not be answered where any other heat generation type as listed in the question is in use in the asset.

## Evidence

1. Extract of manufacturer literature stating the boiler efficiency
2. Photographic evidence of installed boiler.

## Additional information

### Other information

To assess a CHP unit using BREEAM In-Use, select the 'main generation type for space heating' as 'other on site e.g. CHP/solar thermal'. In order to account for the fact that the overall efficiency of the CHP system would not be recognised by entering the actual CHP thermal efficiency, the efficiency value to be entered should be calculated as follows:

$$Overall\ efficiency = thermal\ efficiency + (2 \times electrical\ efficiency)$$

As an example, if the thermal efficiency was 50%, and the electrical efficiency 35%, then the calculated efficiency would be:

$$50\% + (2 \times 35\%) = 120\%$$

# Asset Performance ENE 07 – Heat pump efficiency

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

For **heat pump** generation type, please enter coefficient of performance (COP), if known.

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Heat pump coefficient of performance (COP) |

## Assessment criteria

1. If there is more than one heat pump the assessor should base the COP figure on the average COP of the two systems. This can be weighted based upon respective system capacities.
2. The coefficient of performance (COP) of a heat pump is calculated as the ratio of heating or cooling provided to electrical energy consumed. COP entered must not be higher than 7.

## Evidence

1. Extract of O&M or copy of manufacturer information or other efficiency data from another valid source.
2. Visual inspection of installed heat pump(s) backed up by photographic evidence.

## Additional information

-

# Asset Performance ENE 08 – Fuel usage for heat generation

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the main fuel used for heat generation?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | Electric |
| - | Solid fossil fuel |
| - | Oil |
| - | Gas |
| - | Other |

## Compliance requirement

1. The main fuel used for heat generation is the fuel type for the main source of heat generation, regardless of whether the source of heat generation is on site or off site.
2. If a building is connected to a district heating system, then it is the main fuel type for the district heating system that should be entered.
3. If the main fuel used for heat generation is biomass/biofuel, select ‘Other’.

## Evidence

1. Photographic evidence of the listed heat generating equipment.
2. Extract of O&M manual or copy of manufacturer information for relevant equipment.

## Additional information

-

# Asset Performance ENE 09 – Heat distribution

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the predominant medium by which heat is distributed around the asset?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | By air |
| - | By water |
| - | By refrigerant |
| - | Other |
| - | Local heating – no heat distribution system |

## Assessment criteria

-

## Evidence

1. Photographic evidence of listed system, indicating distribution method.
2. Extract of O&M manual or copy of manufacturer information indicating medium for heat distribution.
3. Installation diagrams.

## Additional information

### Relevant definitions

**Distribution medium:** For the purposes of this BREEAM In-Use issue, the distribution medium refers to the medium that is used to distribute the heat from the point at which it is generated, to the point at which it is required. Listed below are examples of typical media by which heat is distributed for specific heat distribution type:

a) For a conventional gas boiler/radiator system, the medium will be water.

b) For an air conditioned building, the medium may be air if hot/cold air ducted throughout building, or it may be refrigerant if external condensers are connected to indoor units.

c) For heat pumps, the medium may be a refrigerant.

# Asset Performance ENE 10 – Heat emitter type

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the main heat emitter type?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | Asset is not heated |
| - | Radiators |
| - | Fan coil units |
| - | Ducted warm air |
| - | Direct radiant heating |
| - | Underfloor heating |
| - | Other |

## Assessment criteria

-

## Evidence

1. Photographic evidence of the listed equipment.
2. Extract of O&M manual.
3. Building schematics.

## Additional information

### Relevant definitions

**Main heat emitter type:** For the purposes of this BREEAM In-Use issue, the main heat emitter type is the main type through which heat is emitted in to the space/area for which heating is required.

Description of listed heat emitter types:

a) Radiator is a device that warms a space by radiating heat by running a hot liquid through exposed elements (fins or pipes)

b) Fan coil unit is a device consisting of a heating coil and fan used to warm a space

c) Ducted warm air heating a space by providing hot air to it through ductwork

d) Direct radiant heating warms a space by emitting heat from a warm element, such as a floor, wall or overhead panel, warming people and other objects in the space rather than heating the air.

e) Underfloor heating is a form of central heating in which spaces are heated through the floor (either by directly warming people and objects or by heating the air in the space)

# Asset Performance ENE 11 – Mechanical and electrical heating equipment

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

In what year was the main heat generator/heating system installed/replaced (if known)?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | 2006 + |
| - | 2002 – 2005 |
| - | 1995 – 2001 |
| - | 1990 – 1994 |
| - | 1985 – 1989 |
| - | 1965 – 1984 |
| - | 1945 – 1964 |
| - | 1920 – 1945 |
| - | Pre 1920 |

## Assessment criteria

-

## Evidence

1. Copy of documentation outlining when heat generator or heating system was installed or replaced, such as,
    a) Extract of O&M manuals or copy of manufacturer information for heat generator/heating system
    b) Service records

c) Installation records

d) Maintenance records

2. Photographic evidence of heating system(s) if possible).

## Additional information

-

# Asset Performance ENE 12 – Cooling system

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the main system type for cooling?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | Asset is not cooled |
| - | Localised (room) air conditioning unit |
| - | Chiller |
| - | Desiccant cooling system |
| - | Evaporative cooling |
| - | Ground cooling (air) |
| - | Ground cooling (water) |
| - | Sea/river/lake water cooling |
| - | Other |

## Assessment criteria

-

## Evidence

1. Photographic evidence of relevant systems.
2. Extract of relevant O&M manuals or copy of manufacturer information.

## Additional information

### Relevant definitions

Descriptions of typical cooling systems are as follows:

a) Localised (room) air conditioning unit: cooling is typically supplied stand-alone, all in one, (most commonly) wall mounted unit. This does not include temporary/mobile units or small split systems (where the system type selected should be chiller).

b) Chiller: cooling is supplied via a system that uses a machine (chiller) that removes heat from a liquid via a vapour-compression or absorption refrigeration cycle. This liquid can then be circulated through a heat exchanger to cool air or equipment as required. These systems are typically (but not limited to):

   i. an outdoor unit serving a split system

   ii. a centralised chiller, typically roof mounted, or housed externally

c) Desiccant cooling system: desiccant cooling relies on the moisture absorption properties of hygroscopic materials.

d) Evaporative cooling: the evaporation of water is used to decrease the dry bulb temperature of air, Evaporative cooling can be direct (water evaporated directly into supply air stream), or indirect (secondary air stream is cooled directly and then exhausted).

e) Ground cooling (air): cooling is provided by drawing outdoor air into the building via an underground duct system where the air exchanges heat with the ground.

f) Ground cooling (water): cooling is provided by extracting ground water and passing through a heat exchanger before returning to the ground. Can be open loop or closed loop.

g) Sea/river/lake water cooling: cooling is provided by pumping water from an open body of water by an open loop system with cooling extracted via a heat exchanger.

# Asset Performance ENE 13 – Efficiency of cooling generator

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

Please enter the Energy Efficiency Ratio (EER) of the cooling generator, if known.

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Energy efficiency ratio (EER) of generator |

## Assessment criteria

1. The EER of the cooling generator should not be larger than 7.

## Evidence

1. Extract of relevant O&M manuals or copy of manufacturer information or other efficiency data from another valid source.
2. If there is more than one cooling generator the assessor should base the EER figure on the average EER of the two systems. This must be weighted based upon the capacity of the systems.

## Additional information

### Other information

To assess CCHP/absorption chillers using BREEAM In-Use, select the 'main system type for cooling' as 'Chiller'. The energy efficiency ratio (EER) for cooling generator should then be calculated as follows:

$$EER = rated\ absorption\ chiller\ COP \times 2$$

As an example, if the absorption chiller COP was 0.7, then the calculated energy efficiency ratio to be entered into the tool would be:

$$0.7 \times 2 = 1.4$$

Where the calculated EER is below the minimum value that can be entered into the tool, please enter the minimum value. This correction is made to cancel out the primary energy factor normally applied for electrical chillers that would not be applicable in this instance.

**Please note:** absorption chillers are unlikely to score highly under the current methodology due in part to the use of the primary energy metric. The score will however be balanced to some degree by an improved score against the heating end use component where CCHP is used.

# Asset Performance ENE 14 – Cooling distribution

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the predominant medium by which cooling is distributed around the asset?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | Local (room) cooling |
| - | By air |
| - | By water |
| - | By refrigerant |
| - | Other |

## Assessment criteria

-

## Evidence

1. Extract of relevant O&M manuals or copy of manufacturer information.
2. Photographic evidence of relevant systems.

## Additional information

### Relevant definitions

**Cooling distribution medium:** For the purposes of this BREEAM In-Use issue, the distribution medium refers to the medium that is used to distribute the 'coolth' from the point at which it is generated, to the point at which it is required.

Descriptions of typical cooling systems and the cooling medium are as follows:

a) Chiller: by refrigerant

b) Desiccant cooling system: typically by air

c) Evaporative cooling: by air

d) Ground cooling: either by air or water

e) Sea/river/lake water cooling: typically by water

# Asset Performance ENE 15 – Air distributed cooling system

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the system subtype for **air distributed** cooling systems?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | Single duct constant volume |
| - | Single duct variable volume |
| - | Dual duct |
| - | Other |

## Assessment criteria

1. This question **only** refers to assets that have air distributed cooling systems installed.

## Evidence

1. Extract of relevant O&M manuals or copy of manufacturer information.
2. Photographic evidence of relevant systems.

## Additional information

### Other information

Descriptions of typical air distributed cooling systems are as follows:

a) Single duct constant volume systems maintain a constant air volume and vary the supply air temperature in response to space conditions.

b) Single duct variable volume systems control the temperature in a space by varying the quantity of air supplied, rather than the supply air temperature.

c) Dual duct systems use two separate ducts to circulate both cooled and heated air.

# Asset Performance ENE 16 – Refrigerant cooling system

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the system subtype for **refrigerant** cooling systems?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | Split system |
| - | Variable refrigerant flow (VRF) system |
| - | Other |

## Assessment criteria

-

## Evidence

1. Extract of relevant O&M manuals or copy of manufacturer information.
2. Photographic evidence of relevant systems.

## Additional Information

### Relevant definitions

Descriptions of refrigerant cooling subtypes are as follows:

a) Split system – This subtype utilises one external condensing unit/heat pump, which connects, via refrigerant pipework, to the indoor unit. These 'master and slave' type systems can serve multiple rooms which have similar heating/cooling loads. In these systems only one indoor unit is utilised as a master temperature control sensor. Split systems work with a limited number of indoor units.

b) Variable refrigerant flow (VRF) system – This subtype again utilises one external condensing unit/heat pump, which is connected to several indoor units. However these systems allow versatility between heating /cooling loads and work independently of each other. VRF systems can work with many more units than split systems (e.g. up to 16 is fairly typical) and can provide simultaneous heating and cooling, and heat recovery.

# Asset Performance ENE 17 – Cooling emitter type

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the main cooling emitter type?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Asset Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | Air ducts |
| - | Radiators |
| - | Fan coil units |
| - | Direct radiant cooling, e.g. passive chilled beams |
| - | Fan assisted cooling, e.g. active chilled beams |
| - | Induction units |
| - | Other |

## Assessment criteria

1. If more than one cooling emitter type is in use the selection must be that which distributes the most common cooling load within the building.

## Evidence

1. Photographic evidence of installed cooling systems.
2. Extract of relevant O&M manuals or copy of manufacturer information.
3. Installation diagrams.

## Additional information

### Relevant definitions

**Main emitter type:** For the purposes of this BREEAM In-Use issue, the main emitter type is the main type through which ‘coolth’ is emitted in to the space/area for which cooling is required.

Descriptions of emitter types are listed below:

a) Air duct: a tube, canal, pipe, or similar through which coolth is delivered to a room.

b) Radiator: a temperature-controlled surface that cools indoor temperatures by removing heat.

c) Fan coil unit is a device consisting of a cooling coil and fan used to cool a space.

d) Direct radiant cooling (e.g. passive chilled beam): a space is cooled through a temperature-controlled surface that cools indoor temperatures by removing sensible heat. There is no mechanical component to force the air through the system.

e) Fan assisted cooling (e.g. active chilled beam): a space is cooled through the recirculation of cool air by a fan. This fan could be installed in combination with direct radiant cooling to increase its cooling capacity.

f) Induction units: a space is cooled by a process in which induced room air is cooled by a water coil to the extent needed to control the room temperature.

# Asset Performance ENE 18 – Glazing

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What percentage of the external elevation is glazed?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Percentage of external elevation that is glazed (%) |

## Assessment criteria

-

## Evidence

1. Photographic evidence of building from all sides.
2. Building elevations

## Additional information

-

# Asset Performance ENE 19 – Mechanical and electrical cooling equipment

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

In what year was the main chiller/cooling system installed/replaced (if known)?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | 2006 + |
| - | 2002 – 2005 |
| - | 1995 – 2001 |
| - | 1990 – 1994 |
| - | 1985 – 1989 |
| - | 1965 – 1984 |
| - | 1945 – 1964 |
| - | 1920 – 1945 |
| - | Pre 1920 |

## Assessment criteria

-

## Evidence

1. Extract of relevant O&M manuals or copy of manufacturer information for chiller/cooling system.
2. Service/maintenance records for the chiller/cooling system.
3. Visual inspection of equipment date (photographic evidence if possible).

## Additional information

-

# Asset Performance ENE 20 – Specific fan power

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What is the specific fan power for air handling systems?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | 5 – $WL^{-1}s^{-1}$ |
| - | 3 – $WL^{-1}s^{-1}$ |
| - | 1 – $WL^{-1}s^{-1}$ |
| - | Other |

## Assessment criteria

1. In this instance, air handling systems are systems (usually centralised) which distribute air (usually for cooling) around the building.

## Evidence

1. Extract of relevant O&M manuals or copy of manufacturer information.

## Additional information

-

# Asset Performance ENE 21 – Leakage tests

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What are the results of duct and air handling leakage tests?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | Not applicable |
| - | No test |
| - | Class A result |
| - | Class B result |
| - | Other |

## Assessment criteria

1. Class A and Class B results for duct and air handling leakage tests are:

   $Class\ A: f = 0.027 \cdot p^{0.65}$

   $Class\ B: f = 0.009 \cdot p^{0.65}$

   Where:

   f = air leakage in $l.s^{-1}.m^2$

   p = static pressure in Pa:

   As referenced in:

   EN 13779:2007 Ventilation for non-residential buildings. Performance requirements for ventilation and room-conditioning systems.

## Evidence

1. Copy of duct and air handling leakage test results.

# Additional information

## Other information

The maximum score is awarded for Class A systems i.e. those with the lowest air leakage rates.

# Asset Performance ENE 22 – Mechanical and electrical ventilation equipment

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

In what year was the main ventilation system installed/replaced (if known)?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | 2006 + |
| - | 2002 – 2005 |
| - | 1995 – 2001 |
| - | 1990 – 1994 |
| - | 1985 – 1989 |
| - | 1965 – 1984 |
| - | 1945 – 1964 |
| - | 1920 – 1945 |
| - | Pre 1920 |

## Assessment criteria

-

## Evidence

1. Extract of relevant O&M manuals or copy of manufacturer information for ventilation system.
2. Service/maintenance records for the ventilation system.
3. Visual inspection of equipment date (photographic evidence if possible).

## Additional information

-

# Asset Performance ENE 23 – Water heating

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What type of water heating is provided?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don't know |
| - | Point of use |
| - | Centralised |
| - | Other |

## Assessment criteria

1. This question pertains to the predominant system which is used for hot water generation within the asset and does not include systems that are used to heat spaces.

## Evidence

1. Photographic evidence of water heating systems.
2. Extract of relevant O&M manuals or copy of manufacturer information.
3. Installation diagrams.

## Additional information

### Relevant definitions

Commonly used water heating types:

a) Point of use: hot water is directly provided from a tap for drinking and cooking, i.e. via an instant hot water device.

b) Centralised: hot water for drinking and cooking is provided centrally, i.e. through a boiler.

# Asset Performance ENE 24 – Water heating energy sources

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What energy source is used to heat water? If there is a mixture of centralised and point of use systems please select the energy source type of the centralised system.

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | Electric |
| - | Solid fossil fuel |
| - | Oil |
| - | Gas |
| - | Other |

## Assessment criteria

1. If there is a mixture of centralised and point of use systems, the energy source type of the centralised system should be selected.

## Evidence

1. Photographic evidence of relevant system.
2. Extract of relevant O&M manuals or copy of manufacturer information.
3. Installation maps.

## Additional information

### Relevant definitions

Some examples of water heating include (but are not limited to):

a) Point of use, likely to be electric

b) Boiler or water heater, likely to be gas or oil

# Asset Performance ENE 25 – High frequency ballast

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What percentage of fluorescent lamps has high frequency ballasts?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | There are no fluorescent lamps |
| - | 0 to <50% |
| - | ≥50% to <75% |
| - | ≥75% to <100% |
| - | 100% |
| - | Other |

## Assessment criteria

-

## Evidence

1. Photographic evidence of ballasts used for fluorescent lamps.
2. Copy of relevant manufacturer literature (if necessary).
3. Copy of building plans highlighting areas which use fluorescent lamps with high frequency ballasts.

## Additional information

### Relevant definitions

**High frequency ballast** is delivered through a device that is designed to limit the current through the tube of a fluorescent lamp and to optimally operate a fluorescent lamp.

# Asset Performance ENE 26 – Internal lighting types

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

Of all internal lamps, what percentage is of the type as listed below?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Percentage of Compact Fluorescent lighting (%) |
| - | Percentage of Tungsten Halogen lighting (%) |
| - | Percentage of Incandescent lamps lighting (%) |
| - | Percentage of T12 type lighting (%) |
| - | Percentage of T8 type lighting (%) |
| - | Percentage of T5 type lighting (%) |
| - | Percentage of LED type lighting (%) (with a special lighting control system) |
| - | Percentage of LED type lighting (%) (with a typical lighting control system) |
| - | Percentage of metal halide type lighting (%) |

## Assessment criteria

1. For LED type lighting with a special lighting control system:

   Special design lighting control systems allow the user to control all lighting within the asset from a central location. Other features include pre-set scene lighting levels for varying spaces, for example dimming levels etc. Special lighting systems include a variety of different control panels such as: integration to automated control systems and video controls. These lighting systems allow multiple zones to be created to allow for an improvement in energy efficiency.

2. For LED type lighting with a typical lighting control system:

   Typical lighting control systems utilise stand-alone control within the space, whereby adjustment occurs only at the lighting location. Examples could include occupancy sensors and daylight sensors etc. Typical lighting systems include an on/off switch and can include dimming settings.

3. Valid responses for each lamp type questions are in percentage (%) values and must equal 100%.

## Evidence

1. Photographic evidence of visual inspection of lighting types used.
2. Copy of building plans highlighting areas which use the mentioned lighting types.

## Additional information

-

# Asset Performance ENE 27 – Automatic lighting controls

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What percentage of the building floor area (not accessible to clients/customers) with access to daylight has fully functioning daylight sensors for lighting?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | 0% |
| - | >0% to ≤25% |
| - | >25% to ≤50% |
| - | >50% to ≤75% |
| - | >75% |

## Assessment criteria

-

## Evidence

1. Photographic evidence of visual inspection of daylight sensors.
2. Copy of building plans highlighting areas which use daylight sensors for lighting.

## Additional information

-

# Asset Performance ENE 28 – Occupancy sensors

| Number of credits available | Minimum standards |
|---|---|
| Credits are calculated within the Energy Model | No |

## Question

What percentage of the building floor area (not accessible to client/customers) has fully functioning occupancy sensors for lighting?

## Aim

This data is required to generate the asset energy rating.

## Available credits

| Credits | Input calculated in Energy Model |
|---|---|
| - | Question not answered |
| - | Don’t know |
| - | 0% |
| - | >0% to ≤25% |
| - | >25% to ≤50% |
| - | >50% to ≤75% |
| - | >75% |

## Assessment criteria

-

## Evidence

1. Photographic evidence of visual inspection of lighting sensors.
2. Copy of building plans highlighting areas which use occupancy sensors for lighting.

## Additional information

-