Guidance Note GN48 V1.1 February 2022

Ene 01 Calculation Methodology for BREEAM International New Construction Version 6

Summary

This guidance note describes the calculation methodology for energy performance under the Ene 01 issue of BREEAM International New Construction Version 6.

Contents

Schedule of changes

Version	Release date	Description of change
1.0	Dec 2021	Initial release
1.1	Feb 2022	Correct typo in stage 3 example calculation (weighted carbon dioxide ratio).

Introduction

This guidance note describes the methodology for determining the number of credits achieved for energy performance under the Ene 01 assessment issue for BREEAM International New Construction Version 6. For guidance relating to BREEAM International New Construction 2016 please see Guidance Note 25 (GN25).

The methodology uses a triple metric approach that addresses energy demand, energy consumption, and CO_2 emissions. The aim of using this approach is to recognise and promote designs that minimise energy consumption in buildings, and reduce the carbon emissions from that energy use.

The triple metric approach

Credits are awarded where the performance of the actual building exceeds that of a reference baseline. The reference baseline is set by local building regulations.

The methodology considers three **parameters** of the modelled performance of a new building:

- **Heating and cooling energy demand**
- **Primary energy consumption**
- **Carbon dioxide (CO_2-eq) emissions**

A suitably qualified energy modelling engineer is required to calculate performance information using **Approved Building Energy Software (ABES)**. This is software which follows the **National Calculation Methodology (NCM)** of the country of assessment but may also include dynamic simulation software approved by BRE Global.

An NCM is the official calculation method used by the local building regulations to determine whether a building meets regulation requirements in a specific country. Dynamic simulation software is energy modelling software which is not specific to any country or location, and can be used anywhere to calculate performance.

It will not always be possible to use all three parameters internationally, because the local building regulations, NCM, and ABES, may not generate the required outputs. Performance information is based only on the parameters available, so at least one out of the three must be calculated.

1. The performance of each of the applicable **parameters** is based on the improvement of the actual building compared to the reference baseline (defined by the local building regulations).

2. This 'ratio of performance' is then converted to a **parameter score** using a 'performance translator'.

3. Finally, the individual parameter scores are added together to calculate the overall **Energy Performance Ratio** (EPR_{INC}) and this value is compared to a benchmark scale to calculate the number of credits scored.

Sourcing the necessary performance data

Only performance data that is directly sourced from outputs generated by the ABES can be used to calculate the Ene 01 score.

There might be a difference between the parameters calculated to satisfy local building regulations, and those calculated for BREEAM. Where any of the three metrics are generated by the approved modelling software, they should be included in the calculation of the Ene 01 score, even if there are no associated mandatory compliance requirements in the country of assessment.

Defining the route for assessment

1. Where there is a National Calculation Method (NCM) in the country of assessment, which defines a reference building and the NCM complies with the **EU EPBD (Energy Performance of Buildings Directive)**, the Ene 01 Option 1 standard methodology must be used.*
2. Where there is no NCM in place, or where the NCM does not allow the design team to carry out a full analysis of issues as defined in the EPBD, the design team may:
    a. Carry out a more thorough analysis of the performance of the building using an alternative ABES which is not linked to an NCM.
    b. Use the NCM, but substitute ASHRAE minimum performance requirements for reference building elements which are not defined. For instance, if ventilation and air-tightness requirements are not defined in the NCM, substitute these with ASHRAE minimum performance requirements.
    c. Assess against Option 1 where only the performance of lighting is not defined, but credits for lighting performance may be awarded in accordance with criteria in Option 2. See CN3.6 in Ene 01 for more information.
3. Where the NCM does not allow the design team to undertake a full analysis of issues as defined in the EPBD, the design team may follow the assessment route flow chart (Figure 1) .
4. The Option 2 basic methodology is available to design teams where the above routes are not possible. As energy modelling is the preferred way to demonstrate a building's energy efficiency, only a maximum of 4 credits is available using Option 2.

*If the NCM does not cover a building type or the Shell only / Shell and core project types, Option 1 can still be used according to the guidance given in point 2 above.

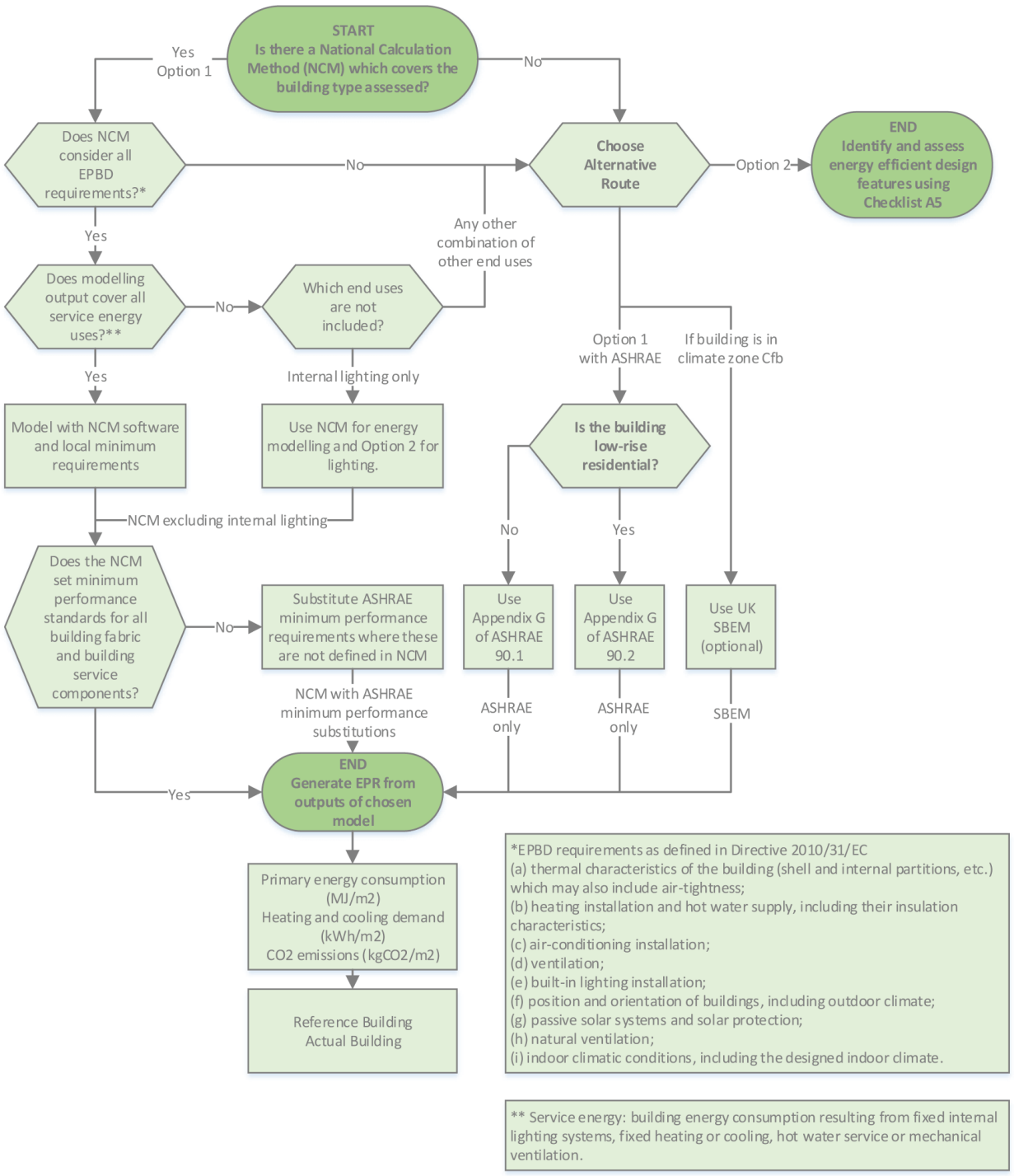


Figure 1: Assessment methodology flow chart

Translating building performance into BREEAM credits

The procedure for translating modelled building performance into BREEAM credits is described in detail below. An example calculation can be found towards the end of this document. This section includes a description of the Ene 01 credits benchmark scale.

In most cases, the performance data required to score credits is generated by the same ABES used by the design team to show compliance with building regulations.

The approved software produces a standard output document. The figures from the output document are then entered into the BREEAM Ene 01 calculator to generate the EPR_{INC} and number of credits achieved.

The BREEAM credits scale and minimum standards

The credit scale is in *Table 26: Ene 01 EPR_{INC} benchmark scale* in the technical manual. There are up to 9 standard credits available.

The minimum EPR_{INC} required to achieve 1 credit is 0.1, which recognises buildings that achieve a moderate improvement over a building regulations compliant design. There is a linear scale up to an EPR_{INC} of 0.9 for 9 credits. Table 1 provides the scheme's minimum standards for Ene 01.

With the exception of Shell only assessments, targeting the 'prediction of operation energy consumption' credits (and demonstrating that operational energy performance has been substantially improved) is an alternative way to gain credits for an Excellent rating.

Table 1: Ene 01 minimum standards

BREEAM credits	EPR_{INC}	Minimum standards
4	0.4	To achieve an Excellent rating
6	0.6	To achieve an Outstanding rating

Energy modelling data required to translate building performance

The performance data parameters required below is sourced from the modelling outputs and manually entered in the tool:

- Building floor area (m^2)
- Actual building heating and cooling energy demand (MJ/m^2yr)*
- Reference building heating and cooling energy demand (MJ/m^2yr)*
- Actual building primary energy consumption (kWh/m^2yr)
- Reference building primary energy consumption (kWh/m^2yr)
- Actual building emission rate ($kgCO_2\text{-}eq/m^2yr$)
- Reference building emission rate ($kgCO_2\text{-}eq/m^2yr$)

* 1kWh = 3.6MJ.

Defining the BREEAM translators

Performance in the parameters is not directly related to scoring in BREEAM. The performance is translated first using a **performance translator.** This is based on real data from a stock of actual buildings, representing different building types.

To align with both the original intent of this methodology (see GN25) and to be consistent with the energy performance scales for other BREEAM schemes, the performance translator curves for the three metrics have been revised.

Carbon

- **Top of scale**: zero regulated carbon.
- **Middle**: 50th percentile of [actual performance ÷ reference performance] for previous INC 2016 assessments.
- **Bottom**: minimum standards from national building regulations.

Energy demand and primary energy consumption

- **Top of scale**: lowest [actual performance ÷ reference performance] values observed for previous INC 2016 assessments.
- **Middle**: 50th percentile of [actual performance ÷ reference performance] for previous INC 2016 assessments.
- **Bottom**: minimum standards from national building regulations.

Unweighted Energy Performance Ratio

The **performance translator curves** convert the modelled performance into an unweighted **Energy Performance Ratio (EPR)**. There is one unweighted EPR for each metric that is modelled.

The EPR is derived by determining the point that the assessed building's performance, as a proportion of actual performance compared with the reference performance, intersects with the translator curve. As shown in Figure 2 - Example Ene 01 performance translator curve.

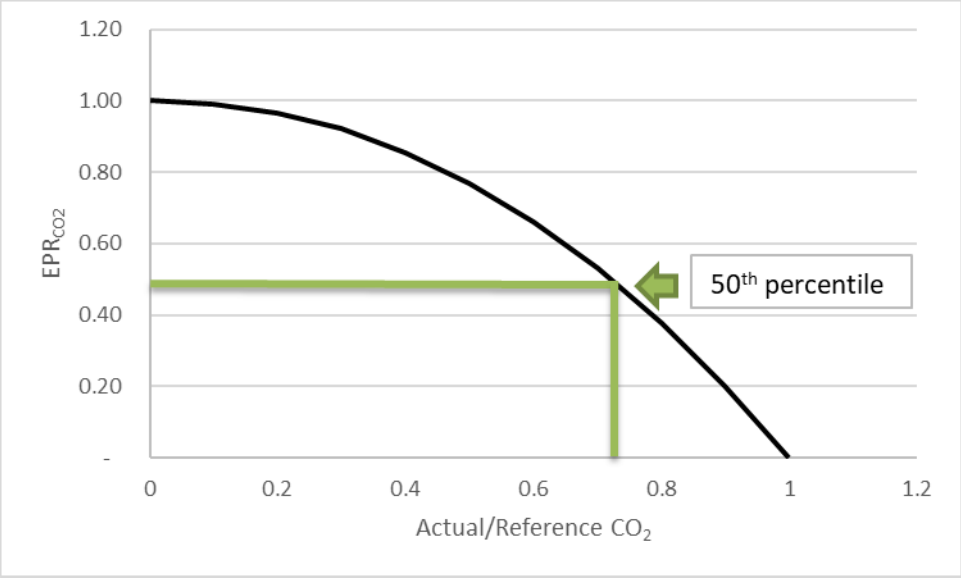


Figure 2: Example Ene 01 performance translator curve

This EPR is formed from the following equation:

EPR (unweighted) = 1 – (A/R)^n

where:

EPR = Energy Performance Ratio (unweighted)

A = actual building performance

R = reference building performance

n = a function of the EPR metrics at the average proportion of actual / reference building performance.

Table 2: 'n' value for each metric

Metric	All countries
Building heating and cooling energy demand	2.648
Primary energy consumption	2.061
Carbon dioxide (CO_2-eq) emissions	2.115

The BREEAM EPR_{INC} weightings

The Ene 01 methodology gives equal weighting to all three-energy metrics to ensure that each metric is given equal consideration when assessing the overall performance in terms of credits. The weighting is calculated as 1 ÷ number of generated metrics. If all three metrics are generated, they are weighted 1/3 each. If only two or one metrics are generated the weighting would be 1/2 or 1/1 respectively.

Table 3: Weightings for each metric and country

Metric	All countries
Building heating and cooling energy demand	1/3
Primary energy consumption	1/3
Carbon dioxide (CO_2-eq) emissions	1/3

Alignment with EU Taxonomy

One of the EU taxonomy requirements for sustainable investment in new construction under the climate change mitigation objectives is to demonstrate a 10% reduction in primary energy consumption over minimum standards (referred to as nearly zero energy standards in the EU).

In BREEAM International New Construction Version 6, an additional output will be generated where this requirement has been met.

The Energy performance of buildings directive (EPBD) requires all new buildings from 2021 (public buildings from 2019) to be nearly zero-energy buildings (NZEB). According to Article 2 "nearly zero-energy building" means a building that has a very high energy performance, and very low operational energy demand. The energy demand should be covered to a very significant extent from renewable sources, including sources produced on-site or nearby.

Calculation process and examples

Stage 1 - Defining the building's performance improvement ratio

The first stage is to calculate the 'building performance improvement ratio' over the reference building. This is done for all three metrics.

To achieve a building performance improvement ratio of less than one for any of the three metrics, the building's actual performance must be better (lower demand, consumption, or emissions) than the reference performance.

$$Building\ performance\ improvement = \frac{Actual\ building\ performance\ (A)}{Refence\ building\ performance\ (R)}$$

Building demand performance ratio = A/R energy demand

Building primary consumption performance ratio = A/R primary consumption

Building CO_2 performance improvement = A/R CO_2 emissions

Stage 1 example:

Demand (MJ/m² yr): *45/80 = **0.563***

Consumption (kWh/m² yr): *200/300 = **0.667***

Emissions (kgCO_2-eq/m² yr): *30/50 = **0.600***

Stage 2 - Benchmarking the performance improvement against the modelled building stock

Each of the building performance improvement figures from Stage 1 is then **translated** into an Energy Performance Ratio (EPR). The translators for each metric are the n values in Table 2.

Stage 2 example:

Unweighted demand ratio: *1 - (0.563 ^ 2.648) = 1 - 0.218 = **0.782***

Unweighted consumption ratio: *1 - (0.667 ^ 2.061) = 1 - 0.434 = **0.566***

Unweighted carbon dioxide ratio: *1 - (0.600 ^ 2.115) = 1 - 0.339 = **0.661***

Stage 3 - Weighting the individual ratios for each metric

The Energy Performance Ratios for each metric from Stage 2 are then multiplied by weightings.

These weightings reflect the maximum that each metric can contribute towards the overall Energy Performance Ratio, EPR_{INC}, and therefore credits. International New Construction Version 6 uses a weighting factor in the Stage 3 calculation to reflect equal importance of the energy metrics:

Weighted EPR_{DEM} *= Building heating and cooling demand weighting x unweighted EPR_{dem}*

Weighted EPR_{PC} *= Primary energy consumption weighting x unweighted EPR_{PC}*

Weighted EPR_{CO2} *= CO_2 weighting x unweighted EPR_{CO2}*

Stage 3 example:

Weighted demand ratio: *0.782/3 = **0.261***

Weighted consumption ratio: *0.566/3 = **0.189***

Weighted carbon dioxide ratio: *0.661/3 = **0.220***

In this example, all 3 metrics are assessed, so the unweighted EPRs are divided equally by 3.

If 2 metrics were assessed, each unweighted EPR is divided by 2.

If 1 metric is assessed, there is no change to the unweighted EPR before going to the next stage.

Stage 4 - Awarding the BREEAM credits

The weighted Energy Performance Ratios for each metric from Stage 3 are totalled to give an overall Energy Performance Ratio for New Construction, EPR_{INC}. This is then compared to the table of benchmarks to determine the number of credits awarded.

See the Ene 01 issue for the credits benchmark scale.

$EPR_{DEM} + EPR_{PC} + EPR_{CO2} = EPR_{INC}$

Stage 4 example:

*Overall EPR_{INC} = 0.261 + 0.189 + 0.220 = **0.670***

Look up the number of credits and the minimum standards achieved from the credit table in the technical manual.

No. of BREEAM credits: 6 BREEAM credits

EU Taxonomy – primary consumption improvement over minimum standards: 33.3%

This meets the minimum standard for an Excellent rating. It will also meet the minimum standard for an Outstanding rating if 4 credits for prediction of operational energy consumption are achieved.

In cases where the actual building performance values are worse than that of the reference building, this will result in an EPR of zero for that metric.

No credits will be awarded if the required parameter for the minimum energy performance standard for the reference building is lower than the actual building.

Appendix A

Heating and cooling energy demand

'Heating and cooling energy demand' is a measure of the annual heating and cooling energy demand, in MJ/m^2 year. It is influenced by factors including the building fabric performance and air permeability, and by heat gains from people, building servicing systems and energy using equipment.

Primary energy consumption

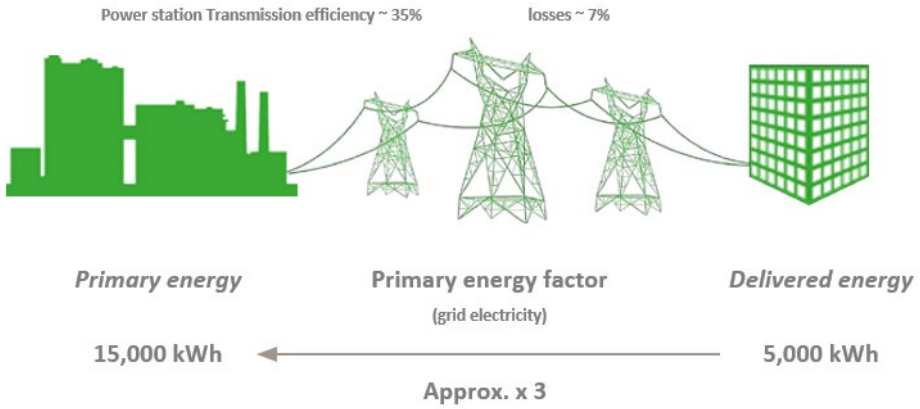
'Primary energy consumption' is a measure of the building's primary energy use in kWh/m^2 year. Primary energy means energy from renewable and non-renewable sources that has not undergone any conversion or transformation process.

Primary energy is transformed by the means of energy generation used (for instance, burning fossil fuels) and transmitted to the building. When it arrives at the building, it is delivered energy.

For a conventional energy supply of gas and electricity, delivered energy is the sum of the gas and electricity use, as read at the building's meters. Delivered energy consumption is also known as operational energy consumption.

Primary energy differs from delivered energy in that, delivered energy is that consumed by the building, and reflects how efficiently a building meets its energy demand.

Primary energy is therefore influenced by both the efficiencies of any on-site building services systems and the efficiencies of energy generation and transmission from the power generators to the building.



CO_2 emissions

The CO_2 emissions metric is a measure of the greenhouse gas emissions the building emits in meeting its predicted energy demands for heating, cooling, ventilation, and lighting, in kgCO_2-eq/m^2 year. It is influenced by factors including building fabric performance, systems and distribution efficiency and fuel source. The specification of low or zero carbon forms of energy generation (on-site or near-site low carbon or renewable energy) are accounted for in this metric.

Triple metric approach

Where all three metrics are available, this approach ensures that 'minimum standard' practice against the energy demand or primary energy consumption cannot be offset by high performance on the carbon metric through the specification of renewable technologies. Therefore, BREEAM seeks to encourage and reward a holistic approach to reducing energy and emissions, through a balance of good building design and systems specification.