VGBC | Vietnam Green Building Council
Hội đồng Công trình xanh Việt Nam

# LOTUS Guidelines

## Energy Use Intensity Benchmarks for LOTUS BIO

(Draft version)

# I. CONTENT

# II. GENERAL

## 1. Introduction

These guidelines aim to provide complete guidance for projects to establish a benchmark energy use intensity value that can be used for the Credit E-2 Building Energy Use Intensity of LOTUS BIO V1.

## 2. Definitions

Building energy use intensity: measured in kWh/m²/year, it is the total energy consumption of the building during one year (kWh/year) divided by the Net Floor Area (NFA) of the building.

Energy benchmark: It is a reference energy consumption upon which the performance of a building can be compared. This reference energy consumption value can be based on other similar buildings, national surveys, past performance of the building, target performance.

Gross Floor Area (GFA): The sum of the fully enclosed covered floor area of a building at all floor levels. Parking areas and non-enclosed roofed-over areas (such as exterior covered walkways, porches, terraces or steps, roof overhangs, and similar features) are not to be included as GFA.

Net Floor Area (NFA): The total gross floor area of a building minus all unoccupied tenancies.

Primary use: The primary use of a building is defined as the primary activity that covers at least 80% of the buildings operations, inclusive of the support areas. Support areas are any miscellaneous areas which support the primary building operations and activities. These include administrative office, store rooms, toilets and common/public areas.
(*Definition adapted from Green Star – developed by the Green Building Council of Australia*)

## 3. Aims of benchmarking

Energy use benchmarking is a process that compares the energy use of a building with a baseline called benchmark. It is a way of describing what constitutes good, average and bad energy performance across a range of situations. By comparing the measured energy consumption of a building with the energy benchmark, it is simple to evaluate the performance of the building in terms of energy efficiency. Without benchmark, it would be impossible to take into account all the situations and all the factors impacting energy use in order to determine whether the performance of a building is actually good or not.

## 4. LOTUS BIO Credit E-2 Building Energy Use Intensity

The credit rewards a maximum of 15 points and combines both the reduction of the building energy use intensity compared to a benchmark (defined for a similar building typology) and compared to the historical performance of the building (with an upper limit of 5 points).

For this credit, it is of first importance to establish a correct energy benchmark and make correct adjustments on the building energy use intensity in order to determine the percentage of energy savings achieved by the building.

# III. BENCHMARKING METHODS

## 1. Comparison with benchmark values set in LOTUS

The first benchmarking method is to use the benchmark values given in the LOTUS Technical Manual. These values are based on a survey of existing buildings realized in Vietnam. Table 1 below indicates the typical operational hours and benchmark energy use intensity to consider for different types of building. The building energy use intensity should be adjusted to match typical operational hours as means to standardize results.

| Building Type | Benchmark Energy Use Intensity (kWh/m²/year) | Operational Hours (hours/week) |
|---|---|---|
| Office | 150 | 52 |
| Hotel | 250 | - |
| Residential | 60 | - |
| Retail | 300 | 84 |

Table 1: Typical operational hours and benchmark Energy use intensity

For building types not listed in Table 1, applicants should follow other benchmarking methods as described below.

## 2. Peer group of comparable buildings

Benchmark values set in Table 1 may not be adapted for all buildings:

- building types that are not included, such as: educational buildings, hospitals, industrial buildings, etc.
- buildings with a high-quality rating such as Grade A offices, 5 stars hotels, etc.
- buildings with specific needs such as supermarkets which are retail buildings but with a need for a big refrigeration system when other types of retail buildings don't need any.

In such cases, another method can be used by projects: make a comparison with a peer group of comparable buildings, which are buildings sharing similar characteristics.

### 2.1 Requirements on the selection of the peer group

First, the peer group must include at least 3 comparable buildings that will be used to set an energy benchmark.

Not any building can be selected to be compared with the project building (the building pursuing LOTUS BIO Certification). For a building to be deemed comparable with the project building, the following eligibility criteria must be satisfied:

- It must have the same primary use type of the project building or, for mixed-use buildings, requirements given in section 'Mixed-use buildings' should be met
- The difference in total NFA must be less than ±50% of the project building.
- The weekly hours of operation must be within ±10% (prior to normalization) of the project building.
- It must feature similar energy systems with the project building
- It must have an equivalent quality rating (office buildings with same grades, hotels with the same number of stars, etc.)
- It must be located in a similar climate zone, unless a weather normalization is done

Example: Selection of Peer group

| Criteria | Project building | Other buildings | | |
|---|---|---|---|---|
| Building | Project building | Building 1 | Building 2 | Building 3 |
| Primary Use Type | Office | Office | Office | Office |
| Grade | A | A | A | B |
| Location | Hanoi | Hanoi | Hanoi | Hanoi |
| Gross floor area [m²] | 5,000 | 3,800 | 7,200 | 12,000 |
| Operational Hour [h/Week] | 56 | 55 | 52 | 54 |

Table 2 : Wrong peer group selection

Only Building 1, Building 2 can be compared with the project building. The Building 3 has not the same office grade as the project building and the difference of GFA is more than 50 % of the project building.

In this case, the project should select another office building to constitute a peer group.

| Criteria | Project Building | Peer Group | | |
|---|---|---|---|---|
| Building | Project building | Building 1 | Building 2 | Building 4 |
| Primary use type | Office | Office | Office | Office |
| Grade | A | A | A | A |
| Location | Hanoi | Hanoi | Hanoi | Ho Chi Minh City |
| Area [m²] | 5,000 | 3,800 | 7,200 | 4,500 |
| Operational Hour [h/Week] | 56 | 55 | 52 | 55 |

Table 3 : Correct of peer group selection

Note that the building 4 is located in Ho Chi Minh City and a weather normalization will have to be performed.

### 2.2 Calculation of the peer group energy benchmark

The peer group energy benchmark can be calculated as the average of the building energy use intensity of all the buildings included in the peer group of comparable buildings.

Example:

Table 4 below shows the energy use intensity of the project building and the three buildings composing the peer group.

| | Project Building | Building 1 | Building 2 | Building 4 |
|---|---|---|---|---|
| Building energy use intensity [kWh/m²/year] | 150 | 170 | 200 | 210 |

Table 4 : Average peer group energy use intensity

$$Average\ peer\ group\ energy\ use\ intensity = \frac{170 + 200 + 210}{3} = 193.33\ [kWh/m^2/year]$$

As result, the project building has an energy use intensity 22.4% lower than the benchmark determined from the peer group of buildings.

## 3. Comparison with historical baseline

In this benchmarking method, the building energy use intensity at Performance period should be compared to the building energy use intensity at Historical period. This benchmarking method is considered in Strategy B of LOTUS BIO Credit E-2 Building Energy Use Intensity.

Projects following this method will be awarded points following Table 5. A comparison with benchmark values for LOTUS or a comparison with a peer group will need to be performed first to determine the performance to reach for points.

| Building EUI at Performance Period | Points allocated |
|---|---|
| Building EUI value is higher than benchmark value | 1 point every 3% of energy use intensity reduction compared to the historical baseline |
| Building EUI value is less than 10% lower than benchmark value | 1 point every 2% of energy use intensity reduction compared to the historical baseline |
| Building EUI value is more than 10% lower than benchmark value | 1 point every 1% of energy use intensity reduction compared to the historical baseline |

Table 5 : Points allocation for energy use intensity reduction compared to the Historical period

Example:

An office building was consuming 180 kWh/m²/year at Historical period. The energy consumption went down to 155 kWh/m²/year at Performance period. The benchmark value set in LOTUS for office buildings is 150 kWh/m²/year (c.f. Table 1).

The building is still consuming more than the benchmark value at Performance period. Thus, 1 point can be awarded every 3% of energy use intensity reduction compared to the historical baseline according to Table 5.

The reduction of energy use intensity compared to the historical baseline can be calculated with the following formula:

$$Reduction\ compared\ to\ historical\ period = \left(1 - \frac{155}{180}\right) = 13.9\ \%$$

Provided that no benchmark adjustments need to be done (c.f. section V.), such a project would earn 4 points in LOTUS BIO.

# IV. MIXED-USE BUILDINGS

The primary use of a building being defined as the primary activity that covers at least 80% of the buildings operations, a number of mixed-use buildings with various functional uses will not be able to determine their primary use.

In order to assess the energy performance of a mixed-use project building, the three benchmarking method above described can still be employed but with more careful attention.

## 1. Comparison with benchmark values set in LOTUS

For mixed-use buildings, a composite benchmark based on the relative percentage of gross floor area allocated to each functional use should be calculated.

Example:

A building with a GFA of 3000 m² includes 1200 m² of general retail and 1800 m² of hotel. The building achieved an energy use intensity of 255 kWh/m²/year during the performance period. The benchmark value set in LOTUS for retail buildings is 300 kWh/m²/year and it is 250 kWh/m²/year for hotel buildings (c.f. Table 1).

Calculation of the benchmark energy use intensity:

$$Benchmark\ \ energy\ use\ intensity = \frac{1200 * 300 + 1800 * 250}{3000} = 270\ kWh/m^2/year$$

Calculation of the reduction of energy use intensity compared to the benchmark:

$$Reduction\ compared\ to\ benchmark = \left(1 - \frac{255}{270}\right) = 5.55\ \%$$

## 2. Peer group of comparable buildings

For mixed-use buildings, the project should also demonstrate that a peer group of buildings is comparable to the project building.

2 methods can be followed to determine the peer group:

- Weighted-average approach:

Pro-rata gross building area into various functional uses and construct an area weighted average performer based on single primary use peer group buildings (e.g. a retail building that exhibits 40% retail shops, 20% restaurants, 30% supermarkets and 10% office can be compared to four separate peer groups of buildings, each exhibiting at least 80% primary use in each of retail shops, restaurants, supermarkets and office functional uses).

For the selection of the peer groups, requirements from section III.2.1 should still be met.

Under this approach, it could be possible to use peer groups of buildings and benchmark values set in LOTUS at the same time.

- Comparable functional spaces approach:

Demonstrate with appropriate supporting documentation that the peer group of mixed-use buildings are comparable to the project building. They should share a large number of functional spaces, have a similar functional use breakup and follow requirements from section III.2.1.

## 3. Comparison with historical baseline

For the comparison with historical baseline, there is no difference between mixed-use buildings and buildings for which a primary use can be determined.

Example:

A building with a GFA of 3000 m² includes 1200 m² of general retail and 1800 m² of hotel. The building was consuming 310 kWh/m²/year during the historical period and the consumption went down to 255 kWh/m²/year during the performance period.

$$Reduction\ compared\ to\ historical\ period = \left(1 - \frac{255}{310}\right) = 17.7\ \%$$

# V. BENCHMARK ADJUSTMENTS

## 1. Weather Adjustment

To improve accuracy of operational ratings, the benchmark can be adjusted with the weather. Some years the weather may be hotter or colder than the typical year and the energy use for HVAC may be heavily impacted.

The adjustment should be made using relevant Cooling Degree Day (CDD) data during the performance period.

If there is any demand of adjustment in a project, VGBC will focus on the correction and approve if an adjustment will be taken into account.

## 2. Occupancy Adjustment

Occupancy define the number of occupied days and hours for a building. Buildings which are occupied for long periods are likely to use more energy than those occupied for short periods.

Adjustments to the standard occupancy assumptions in the benchmark can be made if the building can demonstrate it is occupied for longer periods than the standard hours quoted in benchmark.

Example:
An office building with 60 weekly operational hours has an energy use intensity of 160 kWh/m²/year during the performance period. For office building, a benchmark value of 150 kWh/m²/year is set for 52 weekly operational hours (c.f. Table E.1).

$$Benchmark\ \ adjustment = \frac{150 * 60}{52} = 173.1\ kWh/m^2/year$$

## 3. Other Adjustments

Depending on the type of buildings, other adjustments may be done to normalize the energy use intensity of the project building. The following adjustments can be accepted but subject to VGBC approval:

- For hotels, adjustments based on room occupancy rates, number of covers per guest, etc.
- For factories, adjustments based on productivity (e.g. quantity of material produced, number of pieces manufactured, etc.)

# VI. SEPARABLE ENERGY USES

In some cases, a building may include activities that consume energy and which are not considered typical of that building type. Including these activities could reduce the validity of the comparison with a benchmark. Therefore, it is reasonable to deduct these energy uses (separable energy uses) from the total energy use of the building when making a comparison with a benchmark.

Example of separable energy uses:

Non-exhaustive list of separable energy uses:

- A server room in general office (excluding facilities serving only local or in-building networks)
- Trading floor or dealing floor area (with typically 3 screens per station) in general office
- Bakery oven in a retail space
- Cold storage in a retail space

Requirements for separable energy uses:

In order to be separated from the total energy consumption, the energy use must satisfy the following conditions:

- The energy use is separately and permanently metered
- Meter readings are available for the whole performance period
- The energy use has a documented review of energy consumption and efficiency with improvement proposals

It is advised to projects to get VGBC approval on whether an energy use can be considered as a separable energy use before sending submissions for Certification.

Deduction of separable energy uses:

For each separable energy use satisfying above requirements, the energy use intensity of the project building should be adjusted by:

- deducting the energy consumption of the separable energy use from the total energy consumption of the project building
- deducting the associated floor area of the separable energy use (if any) from the total net floor area

Example:

A supermarket building includes 2 baking ovens in the food processing area and one cold storage room of 20 m2. The net floor area of the building is equal to 3,000 m2 and a total consumption of 960,000 kWh was recorded during the performance period. During the same period, the baking ovens and the cold storage room were separately metered, showing respective energy consumptions of 72,000 kWh and 60,000 kWh. During the energy audit performed 6 months before the beginning of the performance period, the energy use of the baking ovens and cold storage were analyses and some energy saving solutions were recommended and implemented.

The 2 baking ovens and the cold storage room can be considered as separable energy uses as:

Calculation of the energy use intensity of the building:

$$Building\ EUI\ without\ adjustment = \frac{960{,}000}{3000} = 320\ kWh/m^2/year$$

$$Building\ EUI = \frac{960{,}000 - 72{,}000 - 60{,}000}{3000 - 20} = 277.85\ kWh/m^2/year$$

Note that there's no associated floor area for the baking ovens that are free-standing in the food processing area of the supermarket.