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EZ LAND
SUSTAINABLE DEVELOPMENT GUIDELINE

Introduction

This guideline highlights several issues for the EZ Land Development team to consider in order to ensure the sustainability of their development projects. As EZ Land is committed to developing without deteriorating the environment and to setting an example for the industry in responsible and sustainable development, this guideline will help keep the team on track for that mission.

This document is a public and simplified version of a more-detailed internal guideline with clear requirements and step-by-step checklist. The guideline is composed based on the credits from different green building certification systems (LEED, LOTUS, and EDGE) and have also been modified to adapt to current condition of Vietnam's construction industry.

1. Site

EZ Land seeks to prioritize thoughtful decisions about building location for the company's development projects, encouraging:

- Compact development
- Alternative transportation
- Connection with existing amenities

This category not only considers the existing features of the surrounding community and how the infrastructure affects occupants' behavior and environmental performance, but also specifically focuses on restoring project site elements, integrating the site with local and regional ecosystems, and preserving the biodiversity that natural systems rely on.

1.1. Site Selection

1.1.1. Intention

- To avoid the development of environmentally sensitive lands and reduce the environmental impact of the building;
- To conserve land and protect farmland and wildlife habitat by encouraging development in areas with existing infrastructure;
- To promote walkability, and transportation efficiency and reduce vehicle distance traveled;
- To improve public health by encouraging daily physical activities.

1.1.2. Recommended best practice

The Site Selection team should try to achieve as many strategies as possible but at the minimum, the prerequisite and one strategy must be met.

Strategy A. [1] Choose a development site that is located on land that has been previously developed; or that does **not** meet the following criteria for sensitive land:

- Prime farmland or unique farmland;
- Flood hazard area;
- Habitat and species listed as threatened or endangered species; and
- Areas on or within 30 meters of a water body, except for minor improvements.

Strategy B. [2] Locate on a site whose surrounding existing density within a 400-meter radius of the project boundary, with density above 5,050 square meters per hectare of buildable land or 50%.

Strategy C. Locate the site and its main entrance within:

- a 800-meter walking distance of existing or planned bus, streetcar, or rideshare stop; bus transit stops, light or heavy rail stations, commuter rail stations, or commuter ferry terminals [3];
- a 800-meter walking distance of the main entrance of at least 7 diverse uses [4]; and
- a 180-meter walking distance or bicycling distance of a bicycle network that connects to at least 10 diverse uses [5].

1.1.3. References

[1] - LEED v4 BD+C Requirement - Credit Sensitive Land Protection;
[2] - LEED v4 BD+C Requirement - Credit Surrounding Density and Diverse Uses - Option 1;
[3] - LEED v4 BD+C Requirement - Credit Assess to Quality Transit;
[4] - LEED v4 BD+C Requirement - Credit Surrounding Density and Diverse Uses - Option 2;
[5] - LEED v4 BD+C Requirement - Credit Bicycle Facilities.

1.2. Protect or Restore Habitat

1.2.1. Intention

To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

1.2.2. Recommended best practice

During the early design phase, EZ Land's design team must aim to preserve and protect 40% of the greenfield area on the site from all development and construction activity (if such areas exist) [1].

And, using native or adapted vegetation, restore 30% (including the building footprint) of all portions of the site identified as previously disturbed, to meet the requirements [1]:

- Soils (imported and in situ) must be reused for functions comparable to their original function.
- Restored soil must meet the criteria of reference soils in categories 1–3 and meet the criteria of either category 4 or 5:
    1. *organic matter;*
    2. *compaction;*
    3. *infiltration rates;*
    4. *soil biological function; and*
    5. *soil chemical characteristics.*

1.2.3. References

[1] - LEED v4 BD+C Requirement - Credit Site Development | Protect or Restore Habitat - Option 1;
[2] - SITES Guidelines and Performance Benchmarks 2009 - Credit 7.3.

1.3. Open Space

1.3.1. Intention

To create exterior open space that encourages interaction with the environment, social interaction, passive recreation, and physical activities.

1.3.2. Recommended best practice

Provide outdoor space greater than 30% of the total site area (including building footprint). A minimum of 25% of that outdoor space must be vegetated (turf grass does not count as vegetation) or have overhead vegetated canopy [1].

The outdoor space must be physically accessible, and be one or more of the following:

- A pedestrian-oriented paving or turf area with physical site elements that accommodate outdoor social activities, or encourage physical activities;
- A garden space with a diversity of vegetation types and species that provide opportunities for year-round visual interest;
- A garden space dedicated to community gardens or urban food production.
- Wetlands or naturally designed ponds may count as open space if the side slope gradients average 1:4 (vertical: horizontal) or less and are vegetated.

1.3.3. References

[1] - LEED v4 BD+C Requirement - Credit Open Space.

1.4. Heat Island Reduction

1.4.1. Intention

To minimize effects on microclimates and human and wildlife habitats by reducing heat islands effect

1.4.2. Recommended best practice

Strategy A. [1] Over 30% of the paved and applicable roof area limits heat island effect.

Reducing the heat island effect can be achieved by using the design measures below:

- Roofing materials with SRI higher than 78 for low sloped roof (less than 2:12 rise over run) and 29 otherwise;
- Green roofs covered with real vegetation (no artificial turf grass);
- Open grid pavement systems to reduced paved areas (at least 50% pervious);
- Shading devices with solar reflectance index (SRI) higher than 29;
- Shading from existing trees canopy (shades must cover paved or roof areas);
- Paving materials with SRI higher than 29;
- Solar panels.

Strategy B. [2] Place a minimum of 75% of parking spaces under cover.

Any roof used to shade or cover the parking spaces must:

- Have a three-year aged SRI of at least 32 (if three-year aged value information is not available, use materials with an initial SRI of at least 39 at installation);
- Be a vegetated roof; or
- Be covered by energy generation systems, such as solar thermal collectors, photovoltaics, and wind turbines.

1.4.3. References

[1] - LOTUS v3 NC Requirement - Credit Heat Island Effect;
[2] - LEED v4 BD+C Requirement - Credit Heat Island Reduction - Option 2

1.5. Light Pollution Reduction

1.5.1. Intention

To increase night sky access, improve nighttime visibility, and reduce the consequences of development for wildlife and people.

1.5.2. Recommended best practice

Strategy A. [1] Light trespass - Limit illuminance at the site boundary during night time.

Lighting Zone	Horizontal and Vertical illuminance
LZ0	0 lux
LZ1	1 lux
LZ2	4 luxes
LZ3	5 luxes
LZ4	6 luxes

Strategy B. [2] Fully shielded fixtures - All exterior lighting fixtures are fully-shielded.

1.5.3. References

[1] - LOTUS v3 NC - Credit Light Pollution Minimization - Option A
[2] - LOTUS v3 NC - Credit Light Pollution Minimization - Option B

1.6. Rainwater Management

1.6.1. Intention

To reduce stormwater runoff and thus reduce temporary load to local drainage system, reduce urban flooding risks and improve groundwater recharge.

1.6.2. Recommended best practice

Strategy A. [1] Site perviousness - Average perviousness of the site is at least 30%.
Measures to increase the site perviousness include:

- Maximize vegetated areas, such as gardens and lawns;
- Use permeable hardscaping materials for driveways, parking lots and walkways such as:
    - Permeable paving blocks or open-grid pavement
    - Porous asphalt or porous concrete
    - Unbound gravel
    - Wood
    - Mulch
    - Brick, cobbles or natural stone arranged to promote infiltration
- Installation of green roofs.

Strategy B. [2] Stormwater Control - Decrease volume of on-site stormwater runoff from the 2-year storm event by 30%.

The following stormwater control practices can be used to decrease the volume of on-site stormwater runoff by capturing and/or infiltrating stormwater:

- Use of vegetated swales, biofiltration swales, wetlands, dry wells and rain gardens improving water quality and infiltration;
- Installation of retention and/or detention systems;
- Installation of bioretention basins;
- Installation of stormwater harvesting systems capturing stormwater from impervious surfaces.

1.6.3. References

[1] - LOTUS v3 NC - Credit Stormwater Management - Option A
[2] - LOTUS v3 NC - Credit Stormwater Management - Option B

2. Materials

The Materials category focuses on minimizing the embodied energy and other impacts associated with the extraction, processing, transport, maintenance, and disposal of building materials. The requirements are designed to support a life-cycle approach that improves performance and promotes resource efficiency. This category also aims to reduce concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment.

To achieve the goals, the requirements within this category encourage the reuse and recycling of building materials, and the use of materials from sustainable sources as well as low-emitting materials.

2.1. Embodied Carbon

2.1.1. Intention

To reduce the embodied carbon/embodied energy in the building by specifying floor slabs, roof slaps, external/internal walls, floors, window frames, and insulation materials with lower embodied energy than typical building.

2.1.2. Recommended best practice

A building must demonstrate a 20% reduction in embodied energy in materials as compared to typical local practices [1].

Using **EDGE Application** [2] to analyze compliance by choosing each option for floor slabs, roof slaps, external/internal walls, floors, window frames, and insulation materials. EDGE defines a global standard while contextualizing the base case to the building functions and its location.

Table. Base assumptions for building construction materials

No.	Elements	Base case assumption
1	Floor Slabs	In-situ reinforced concrete slab Thickness: 300 mm Rebar ratio: 33 kg/m2
2	Roof Slabs	In-situ reinforced concrete slab Thickness: 300 mm Rebar ratio: 33 kg/m2
3	External Walls	Common brick Thickness: 200 mm
4	Internal Walls	Common brick Thickness: 200 mm
5	Flooring	100% of ceramic tiles
6	Window Frames	Aluminum
7	Insulation	No insulation

2.1.3. References

[1] - EDGE Requirement - Category Materials;
[2] - EDGE Application - https://app.edgebuildings.com/.

2.2. Recyclable Materials

2.2.1. Intention

To encourage projects to use recyclable materials to minimize the use of natural resources.

2.2.2. Recommended best practice

5% of the total value of the materials in the project is from recyclable materials [1].

Calculation is based on cost of materials. When the actual cost of materials is not available, a default cost equal to 45% of the total construction costs should be used.

For credit achievement calculation, products sourced (extracted, manufactured, and purchased) within 160 km of the project site are valued at 200% of their base contributing cost [2].

2.2.3. References

[1] - LOTUS v3 NC - Sustainable Materials;
[2] - LEED v4 BD+C - Requirement for Regional Materials/Products.

2.3. Reuse Materials

2.3.1. Intention

To encourage adaptive reuse and optimize the environmental performance of products and materials.

2.3.2. Recommended best practice

5% of the total value of the materials in the project is from reused materials [1].

Calculation is based on cost of materials. When the actual cost of materials is not available, a default cost equal to 45% of the total construction costs should be used.

For credit achievement calculation, products sourced (extracted, manufactured, and purchased) within 160 km of the project site are valued at 200% of their base contributing cost [2].

2.3.3. References

[1] - LOTUS v3 NC - Sustainable Materials;
[2] - LEED v4 BD+C - Requirement for Regional Materials/Products.

2.4. Low-emitting Materials

2.4.1. Intention

To minimize the negative impacts of hazardous materials such as Volatile Organic Compounds (VOCs) & Formaldehydes from building materials on occupant's health.

2.4.2. Recommended best practice

Achieve one or more of the options below:

Strategy A. [1] Interior paints and coatings
Specify and install low-VOC emission products for all interior paints and coatings.

Strategy B. [2] Other interior categories
Specify and install low-VOC emission products for one or more interior categories below:

- Adhesives and sealants;
- Floorings;
- Composite wood;
- Ceilings, partitions and insulation.

2.4.3. References

[1] - LOTUS v3 NC - Low-Emission Products - Prerequisite;
[2] - LOTUS v3 NC - Low-Emission Products - Strategies A, B, C, and D.

2.5. Material Declaration

2.5.1. Intention

To encourage the use of products and materials for which life-cycle information is available, and that have environmentally preferable life-cycle impacts.

2.5.2. Recommended best practice

Achieve one or more of the options below:

Strategy A. [1] Environmental Product Declaration (EPD).
Use at least 20 different permanently installed products sourced from at least 5 different manufacturers that meet one of the disclosure criteria below:

- Product-specific declaration:
- Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044.
- EPD which conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930:
- Industry-wide (generic) EPD – Products with third-party certification (Type III);
- Product-specific Type III EPD – Products with third-party certification (Type III). Those products are valued as 1.5 products for the purposes of credit achievement calculation.

Strategy B. [2] Multi-Attribute Optimization
Use at least 10% (by cost) of the total value of permanently installed products in the project, that comply with the criteria below:

Third party certified products that demonstrate impact reduction below industry average in at least 03 of the

following categories:

- Global warming potential (greenhouse gases) - CO2e;
- Depletion of the stratospheric ozone layer - kg CFC-11;
- Acidification of land and water sources - moles H+ or kg SO2;
- Eutrophication - kg nitrogen or kg phosphate;
- Formation of tropospheric ozone - kg NOx, kg O3 eq, or kg ethane; and depletion of nonrenewable energy resources - MJ.

For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost.

2.5.3. References

[1] - LEED v4.1 BD+C - Building Product Disclosure and Optimization—Environmental Product Declarations - Option 1;
[2] - LEED v4.1 BD+C - Building Product Disclosure and Optimization—Environmental Product Declarations - Option 2.

3. Energy

As urbanization is speeding all over the world, buildings and construction have been described as a hidden culprit, responsible for more than 35% of global final energy use and nearly 40% of energy-related CO2 emissions (Global status report 2017 coordinated by United Nations Environment Programme).

According to the Vietnam Energy Outlook Report 2017, it is expected that electricity demand will grow by 8% annually on average until 2035 and that almost half of the new power generation capacity needed will be coal fired.

The Energy category encourages efforts taken to reduce the building energy consumption, not only by optimizing passive design solutions like building shape and orientation, thermal performance of building envelope, but also by incorporating energy efficient technologies and energy management system.

3.1. Passive Design

3.1.1. Intention

To identify, analyze and incorporate design solutions that take advantage of the natural climate and site to minimize mechanical cooling and heating in the building, while ensuring comfort for all occupants.

3.1.2. Recommended best practice

Conduct a Passive Design Analysis at early design stage, including following items [1]:

Site conditions:
- Climatic Data;
- Orientation;
- Landscaping;
- Natural Ventilation.

Building parameters:
- Glazing;
- Material and Construction;
- Zoning;
- Shading.

In addition to the above requirements for passive design analysis, the project should perform some thermal and daylight simulations. The aim of these simulations is to assess and further optimize the effectiveness of the passive design strategies.

3.1.3. References

[1] - LOTUS v3 NC - Passive Design Credit.

3.2. Envelope

3.2.1. Intention

To ensure the thermal performance of the building envelope is optimized.

3.2.2. Recommended best practice

Meet the requirements for all following items [1]:

- **Roofs:**
  - Flat roofs and roofs with gradient of less than 15 degrees: overall thermal resistance value $R_{roof} \geq 1.00$ m2.K/W;
  - Roofs with gradient of 15 degrees or above: overall thermal resistance value $R_{roof} \geq 0.85$ m2.K/W;
  - Flat roofs with reflective materials (SR > 0.7): overall thermal resistance value $R_{roof} \geq 0.80$ m2.K/W.

- **External walls:**
  - External walls above the ground surface: overall thermal resistance value $R_{wall} \geq 0.56$ m2.K/W

- **Glazing:**
  - Maximum SHGC values must comply with the values specified in Table below:

Table. WWR-related SHGC for glazing

WWR (%)	SHGC		
	North	South	Other orientations
20	0.90	0.90	0.80
30	0.64	0.70	0.58
40	0.50	0.56	0.46
50	0.40	0.45	0.38
60	0.33	0.39	0.32
70	0.27	0.33	0.27
80	0.23	0.28	0.23
90	0.20	0.25	0.20
100	0.17	0.22	0.17
NOTES: - WWR shall be calculated for each of the façades then averaged for the entire building; - If WWR does not match with the values in the table, SHGC values shall be determined through linear interpolation using the nearest higher and lower WWR values.			

  - Maximum SHGC value of glazed roofs is set at 0.3. For attic spaces designed with daylighting, maximum SHGC value of skylight is 0.6.
  - In case of building facades being installed with permanent vertical or horizontal sunshades, SHGC values in Table above may be adjusted by multiplying them with the A coefficient in Table a and Table b.

Projection Factor PF=b/H	Coefficient A		
	North	South	Other orientations
0.10	1.23	1.20	1.09
0.20	1.43	1.39	1.19
0.30	1.56	1.39	1.30
0.40	1.64	1.39	1.41
0.50	1.69	1.39	1.54
0.60	1.75	1.39	1.64
0.70	1.79	1.39	1.75
0.80	1.82	1.39	1.85
0.90	1.85	1.39	1.96
1.00	1.85	1.39	2.08

NOTES:
- PF (Projection Factor) = b/H; b – projection of sunshade from the window surface; H – distance from the window-sill to the bottom of the sunshade; b and H share the same dimension for length.
- Applicable for continuous horizontal sunshades placed above the upper window edge by a distance d, with d/H ≤ 0.1 (tolerance of less than 10%).

Table a. Coefficient A for permanent vertical sunshades

Projection Factor PF=b/B	Coefficient A		
	North	South	Other orientations
0.10	1.25	1.11	1.01
0.20	1.52	1.19	1.03
0.30	1.75	1.22	1.05
0.40	1.82	1.25	1.06
0.50	1.85	1.28	1.09
0.60	1.85	1.30	1.10
0.70	1.89	1.30	1.12
0.80	1.89	1.30	1.14
0.90	1.89	1.30	1.16
1.00	1.89	1.30	1.18

NOTES:
- PF (Projection Factor) = b/B; b – projection of the vertical sunshade from the surface of fenestration; B – window width from its side edge to the inner contact of vertical sunshade structure; b and B share the same dimension for length.
- Applicable for continuous vertical sunshades placed by a clearance e from to the window edge, with e/B ≤ 0.1 (tolerance of less than 10%).

3.2.3. References

[1] - QCVN 09-2017/BXD - National Technical Regulation on Energy Efficiency Buildings - Envelope requirements;
[2] - EDGE Recommendation - Baseline WWR for buildings;
[3] - QCVN 09-2017/BXD - National Technical Regulation on Energy Efficiency Buildings – Annex 2 & Annex 4.

3.3. HVAC

3.3.1. Intention

To reduce the energy consumption for space cooling.

3.3.2. Recommended best practice

Meet the requirements for one or both strategies below:

Strategy A. Natural Ventilation [1]

A room is naturally ventilated if room dimensions meet the following conditions. These include the "room depth to ceiling height ratio" and the "minimum area of opening".

Table. Room depth to ceiling height ratios for different room configurations

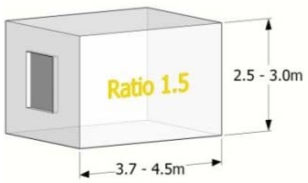
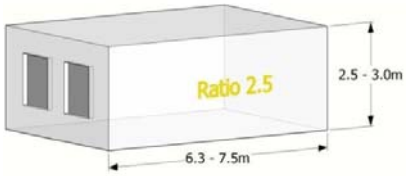
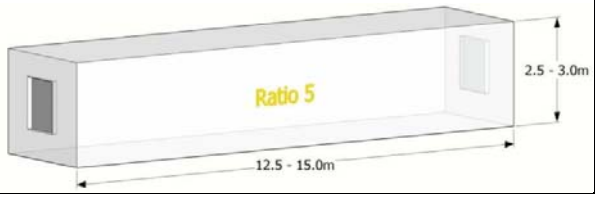
Room/Opening Configuration	Example	Maximum Room Depth to Ceiling Height Ratio
Single-sided, single opening		1.5
Single-sided, multiple openings		2.5
Cross ventilation		5.0

Table. Minimum area of opening as a proportion of floor area for different space types

Building Type	Space Type	Minimum Area of Opening Required as a Percentage of Floor Area
Residential	Bedrooms	20%
	Living Room	20%
	Kitchen	25%
Hospitality	Corridors	10%
	Guest Rooms	20%

Building Type	Space Type	Minimum Area of Opening Required as a Percentage of Floor Area
Retails	Corridors, Atrium & Common Areas	10%
Office	Offices	20%
	Corridors and Lobby	10%
Hospital	Corridors	10%
	Lobby, Waiting and Consultation Areas	20%
	Patient Rooms	20%
Education	Corridors	10%
	Classrooms	20%

Strategy B. Air-conditioning systems [2]

Meet requirements for both Efficiency and Controling.

- Efficiency improvement, compare to the minimum requirement values of **Tables below from QCVN 09:2017/BXD**:
  - 20% improvement of CSPF for non-ducted air-conditioners;
  - 10% improvement of COP for other types of direct electric air-conditioners;
  - 5% improvement of COP for chillers with cooling capacity under 1055 kW;
  - 3% improvement of COP for chillers with cooling capacity above 1055 kW.

Table. Coefficient of performance (COP) for direct electric air conditioners

Type of equipment	Cooling output, kW	COPMin, kW/kW	Test procedures
Unitary air-conditioner	-	2.80(*)	TCVN 6576:2013 TCVN 7830:2015 TCVN 10273-1:2013
Split air-conditioner	< 4.5	3.10(*)	
	≥ 4.5 and < 7.0	3.00(*)	
	≥ 7.0 and < 12.0	2.80(*)	
Air conditioners, air cooled	≥ 14.0 and < 19	3.81	TCVN 6307:1997 or ARI 210/240
	≥ 19 and < 40	3.28	ARI 340/360
	≥ 40 and < 70	2.22	
	≥ 70 and < 223	2.93	
	≥ 223	2.84	
Air conditioners, water	< 19	3.54	ARI 210/240
	≥ 19 and < 40	3.54	ARI 340/360
	≥ 40 and < 70	3.66	

Type of equipment	Cooling output, kW	COPMin, kW/kW	Test procedures
cooled	≥ 70 and < 223	3.63	
	≥ 223	3.57	
Air conditioners, evaporatively cooled	< 19	3.54	ARI 210/240
	≥ 19 and < 40	3.54	ARI 340/360
	≥ 40 and < 70	3.51	
	≥ 70 and < 223	3.48	
	≥ 223	3.43	
Condensing units, air cooled	≥ 40	3.07	ARI 365
Condensing units, water and evaporatively cooled	≥ 40	3.95	
NOTES: Coefficient of performance (COP) = Cooling capacity / Power input (kW/kW); Condenser units include compressor and condenser coils; (*) Unitary air-conditioner or split air-conditioner: Energy efficiency of the equipment shall be determined by Cooling Seasonal Performance Factor (CSPF) instead of COP. The procedure for testing and reviewing energy efficiency of the equipment shall be conducted as per TCVN 7830:2015, TCVN 6576:2013 and TCVN 10273-1:2013 (ISO 5151:2000).			

Table. Coefficient of Performance for Chillers

Type of equipment	Cooling output (kW)	COPMin, kW/kW
Air-cooled chillers, Attached OR separated (3) condenser, electrically operated	All capacities	2.80
Reciprocating water-cooled chillers, electrically operated	Follow the requirements for electric water-cooled rotary screw/scroll chiller	
Rotary screw/scroll water-cooled chillers, electrically operated	< 264	4.51
	≥ 264 and < 528	4.53
	≥ 528 and < 1055	5.17
	≥ 1055	5.67
Centrifugal water-cooled chillers, electrically operated	< 528	5.55
	≥ 528 and < 1055	5.55
	≥ 1055 and < 2110	6.11
	≥ 2110	6.17
Air-cooled absorption, single effect	All capacities	0.60 (*)
Water-cooled absorption, double effect (4)	All capacities	0.70 (*)
Absorption double effect, indirect fired	All capacities	1.00 (*)

Type of equipment	Cooling output (kW)	COPMin, kW/kW
Absorption double effect, direct fired	All capacities	1.00 (*)
NOTES: (*) For absorption chillers, COP = Cooling load / Heat input; Performance of absorption chillers shall be rated as per ARI Standard 560; Performance of water-cooled packages shall be rated as per ARI Standard 550 / 590.		

- Install variable controls on all suitable HVAC systems.

3.3.3. References

[1] - EDGE Requirement - Energy Category - **Natural Ventilation Credit**;
[2] - LOTUS v3 NC - Building Cooling Credit - **Strategy B**.

3.4. Lighting

3.4.1. Intention

- To reduce energy consumption for artificial lighting by using energy efficient systems.

3.4.2. Recommended best practice

Meet the requirements for both strategies below:

Strategy A. Lighting Power Density [1]

Reduce LPD from QCVN 09:2017/BXD requirement of 15% for Residential buildings and 20% for Non-Residential buildings.

Table. Maximum Lighting Power Density (LPD) - QCVN 09:2017/BXD

Type of building	LPD (W/m^2)
Offices	11
Hotels	11
Hospitals	13
Medical and health care centers	11
Library	14
Convention centers	15
Schools	12
Commercial and service buildings	16
Apartments	8
Storage	9
Indoor parking areas	3

NOTES:
- Lighting power density - LPD is calculated as the ratio of the designed total lighting output to total occupied area;
- For mixed-use buildings with multiple functional areas: LPD shall be determined based on lighting output and occupied area of each function;
- For areas or spaces that have specialized lighting needs such as educational or medical facilities: LPD shall be determined as per applied design standards.

Strategy B. Lighting control [2]

Implement a lighting control system in more than 50% of the building GFA and in 100% of the outdoor car park area.

3.4.3. References

[1] - LOTUS v3 NC - Artificial Lighting Credit - Strategy A;
[2] - LOTUS v3 NC - Artificial Lighting Credit - Strategy B.

3.5. Other electrical equipment

3.5.1. Intention

To reduce energy consumption for other processes by using energy efficient equipment.

3.5.2. Recommended best practice

Meet the requirements for both strategies below:

Strategy A. Electric motors [1]

All 3-phase (50 Hz) motors shall have a minimum full-load motor efficiency of no less than the values specified in Table below.

Table. Minimum full-load efficiency for electric motors

Motor output (kW)	Open Motors			Enclosed Motors		
	2 pole	4 pole	6 pole	2 pole	4 pole	6 pole
	Speed (rpm – rounds per minute)					
	3600	1800	1200	3600	1800	1200
0.8	77.0	85.5	82.5	77.0	85.5	82.5
1.1	84.0	86.5	86.5	84.0	86.5	87.5
1.5	85.5	86.5	87.5	85.5	86.5	88.5
2.2	85.5	89.5	88.5	96.5	89.5	89.5
3.7	86.5	89.5	89.5	88.5	89.5	89.5
5.6	88.5	91.0	90.2	89.5	91.7	91.0
7.5	89.5	91.7	91.7	90.2	91.7	91.0

11.1	90.2	93.0	91.7	91.0	92.4	91.7
14.9	91.0	93.0	92.4	91.0	93.0	91.7
18.7	91.7	93.6	93.0	91.7	93.6	93.0
22.4	91.7	94.1	93.6	91.7	93.6	93.0
29.8	92.4	94.1	94.1	92.4	94.1	94.1
37.3	93.0	94.5	94.1	93.0	94.5	94.1
44.8	93.6	95.0	94.5	93.6	95.0	94.5
56.0	93.6	95.0	94.5	93.6	95.4	94.5
74.6	93.6	95.4	95.0	94.1	95.4	95.0
93.3	94.1	95.4	95.0	95.0	95.4	95.0
111.9	94.1	95.8	95.4	95.0	95.8	95.8
149.2	95.0	95.8	95.4	95.4	96.2	95.8
186.5	95.0	95.8	95.4	95.8	96.2	95.8
223.8	95.4	95.8	95.4	95.8	96.2	95.8
261.1	95.4	95.8	95.4	95.8	96.2	95.8
298.4	95.8	95.8	95.8	95.8	96.2	95.8
357.7	95.8	96.2	96.2	95.8	96.2	95.8
373.0	95.8	96.2	96.2	95.8	96.2	95.8

Strategy B. Water heating system [2]

- All water heating equipment and boilers of the building shall maintain a minimum efficiency as specified in Table below:

Table. Minimum efficiency of water heating equipment

Equipment type	Minimum efficiency E_T, %
Gas-fired storage water heaters	78
Gas-fired instantaneous water heaters	78
Gas-fired hot water supply boilers	77
Fuel oil-fired hot water heaters and supply systems	80
Duel fuel gas/oil-fired hot water supply boilers	80
Firewood/paper-fired boiler with output of 10÷350 kW	60
Brown coal-fired boilers with output of 10÷2000 kW	70
Pitcoal-fired boilers with output of 10÷2000 kW	73
Electric resistance water heaters	$E_{min} = 5.9 + 5.3V^{0.5}$ (W)

NOTES:

- The minimum efficiency of gas/oil-fired water heaters is given in form of Thermal efficiency (ET), which includes thermal losses from the heater shells.
- The minimum efficiency of electric resistance water heaters shall be determined according to the maximum Standby Loss (SL), where exists a difference of 40^{O}C between stored water temperature and ambient temperature. In the aforementioned equation, V is volume in liters;
- Test procedure shall be conducted as per ANSI Z21.10.3 or equivalent standards.

- All heat pump water heaters shall maintain a minimum COP as specified in Table below:

Table. Minimum COP of water heating heat pumps

Equipment type	COP, kW/kW
Air-source heat pump water heaters	≥ 3.0
Water-source heat pump water heaters	≥ 3.5
Heat recovery air conditioners: - Hot water supply mode - Air conditioning and hot water supply mode	 ≥ 3.0 ≥ 5.5

- For solar water heating systems: Solar water heaters shall maintain a minimum efficiency of 60% and a minimum thermal resistance value R_0 of 2.2 m^2.K/W at the back of solar panels.

3.5.3. References

[1] - QCVN 09:2017/BXD - Other electrical equipment - Electric motors;
[2] - QCVN 09:2017/BXD - Other electrical equipment - Water heating systems.

3.6. Energy Management

3.6.1. Intention

To support energy management and identify opportunities for additional energy savings by tracking building-level and system-level energy use.

3.6.2. Recommended best practice

Install advanced energy metering for the following [1]:

- all whole-building energy sources used by the building; and
- any individual energy end uses that represent 10% or more of the total annual consumption of the building.

The advanced energy metering must have the following characteristics [1]:

- Meters must be permanently installed, record at intervals of one hour or less, and transmit data to a remote location;
- The data collection system must use a local area network, building automation system, wireless network, or comparable communication infrastructure;
- The system must be capable of storing all meter data for at least 36 months;

- All meters in the system must be capable of reporting hourly, daily, monthly, and annual energy use.

3.6.3. References

[1] - LEED v4 BD+C - Advanced Energy Metering Credit.

4. Renewable Energy

The Renewable Energy category promotes the use of renewable sources of energy and encourage their use in the built environment. Using renewable energy sources can help to reduce the overall energy consumption, environmental impacts and CO2 emissions of a building. The application of renewable energy strategies in buildings are presently uncommon in Vietnam and should be promoted in the interest of sustainable development.

4.1. On-site systems

4.1.1. Intention

- To reduce the environmental and economic harms associated with fossil fuel energy by increasing self-supply of renewable energy.

4.1.2. Recommended best practice

At least 1% of the total energy used in the building is produced from renewable sources [1].
Valid forms of renewable energy include:

- Photovoltaic (PV) & Solar Thermal (including solar water heating);
- Geothermal (in some cases);
- Wind;
- Biofuel (in some cases);
- Micro-hydro; etc

Renewable energy may be available from a third-party system, or the project team may enter an arrangement in which a third party owns a system that serves the project.

4.1.3. References

[1] - LEED v4 BD+C - Renewable Energy Production Credit.

4.2. Demand Response

4.2.1. Intention

To increase participation in demand response (DR) technologies and programs that make energy generation and distribution systems more efficient and reduce greenhouse gas emissions.

4.2.2. Recommended best practice

Enroll in a minimum one-year DR participation commitment with a qualified DR program provider, for at least 10% of the estimated peak electricity demand. Peak demand is determined under whole-building energy simulation [1].

4.2.3. References

[1] - LEED v4 BD+C - Demand Response Credit.

4.3. Net Zero Carbon Design

4.3.1. Intention

To encourage the reduction of greenhouse gas emissions through the use of grid-source, renewable energy technologies and carbon mitigation projects by applying building energy performance assessment in the design stage and operation stage.

4.3.2. Recommended best practice

By using whole-building energy simulation in the design stage, demonstrate an improvement of 40% in the proposed building performance rating compared with the baseline building performance rating. And, in the operation stage, demonstrate 100% of total building energy use come from **green power/renewable energy certifcates (RECs) or carbon offset programs. [1]**

4.3.3. References

[1] - EDGE IFC/Worldbank - **EDGE Zero Carbon certification**.

5. Water

The conservation and creative reuse of water are important because only 3% of Earth's water is fresh water. Typically, most of a building's water cycles through the building and then flows off-site as wastewater.
The Water Category addresses water holistically, looking at indoor use, outdoor use, specialized uses, and metering. This category looks at water efficiency and reductions in potable water use, and then, additionally recognize the use of nonpotable and alternative sources of water.

5.1. Drought-tolerant Landscape

5.1.1. Intention

To limit the use of domestic water for irrigation by promoting landscape designs which incorporate native/adapted species.

5.1.2. Recommended best practice

Show that the landscape does not require a permanent irrigation system beyond a maximum two-year establishment period [1].

5.1.3. References

[1] - LEED v4 BD+C - Outdoor Water Use Reduction Prerequiste - Option 1.

5.2. Irrigation System

5.2.1. Intention

To reduce the use of domestic water for irrigation by using efficient irrigation system and/or alternaltive water sources.

5.2.2. Recommended best practice

Reduce the project's landscape water requirement (LWR) by at least 30% from the calculated baseline for the site's peak watering month. Reductions must be achieved through plant species selection, irrigation system efficiency, and an alternative water source, as calculated by the Environmental Protection Agency (EPA) WaterSense Water Budget Tool [1].

5.2.3. References

[1] - LEED v4 BD+C - Outdoor Water Use Reduction Prerequiste - Option 2.

5.3. Indoor Water Uses

5.3.1. Intention

To reduce indoor water consumption by using water efficient fixures.

5.3.2. Recommended best practice

Meet the requirements for both Building water use and Appliance/Process water use [1]:

- For flush and flow fixtures as applicable to the project scope, reduce aggregate water consumption by 20% from the baseline, using Indoor Water Use Caculation Sheet by WaterSense;

- For Appliances:

Appliance	Requirement
Residential clothes washers	ENERGY STAR or performance equivalent
Commercial clothes washers	CEE Tier 3A
Residential dishwashers (standard and compact)	ENERGY STAR or performance equivalent
Prerinse spray valves	≤4.9 lpm
Ice machine	ENERGY STAR or performance equivalent and use either air-cooled or closed-loop cooling, such as chilled or condenser water system

5.2.1 References

[1] - LEED v4 BD+C - Indoor Water Use Reduction Prerequiste.

5.4. Water Metering

5.4.1. Intention

To support water management and identify opportunities for additional water savings by tracking water consumption.

5.4.2. Recommended best practice

Install water meters for two or more of the following water subsystems, as applicable to the project [1]:

- Irrigation. Meter water systems serving at least 80% of the irrigated landscaped area;
- Indoor plumbing fixtures and fittings. Meter water systems serving at least 80% of the indoor fixtures and fitting.
- Domestic hot water. Meter water use of at least 80% of the installed domestic hot water heating capacity;
- Reclaimed water. A reclaimed water system with a makeup water connection must also be metered so that the true reclaimed water component can be determined.
- Other process water. Meter at least 80% of expected daily water consumption for process end uses, such as humidification systems, dishwashers, clothes washers, pools, and other subsystems using process water.

5.4.3. References

[1] - LEED v4 BD+C - Water Metering Credit.

6. Waste Management

Vietnam's urban areas generate over 11 million tonnes of solid waste per year, of which 84% is collected and treated (report from the Centre for Environmental Monitoring Portal under the Vietnam Environment Administration, 2014). This means almost 2 million tonnes of untreated solid waste is released into the environment each year.
The Waste Management category includes two main goals which are to promote the reuse and recycling of building materials in operation stage, and to reduce the amount of waste generated in the construction stage.

6.1. Storage and Collection of Recyclables

6.1.1. Intention

To reduce the waste that is generated by building occupants and disposed of in landfills.

6.1.2. Recommended best practice

Provide **dedicated areas** accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building. Recyclable materials must include mixed paper, corrugated cardboard, glass, plastics, and metals. Take appropriate measures for the safe collection, storage, and disposal of two of the following: batteries, mercury-containing lamps, and electronic waste [1].

6.1.3. References

[1] - LEED v4 BD+C - **Storage and Collection of Recyclable Prerequisite**.

6.2. Construction Waste Management

6.2.1. Intention

To reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials.

6.2.2. Recommended best practice

Strategy A. Reuse, salvage and/or recycle 50% of the demolition and construction waste. Calculation is based on volume or weight [1].

Strategy B. Do not generate more than 12.2 kilograms of construction waste per square meter of the building's floor area [2].

6.2.3. References

[1] - LEED v4 BD+C - Construction and Demolition Waste Management Credit - **Option 1**.
[2] - LEED v4 BD+C - Construction and Demolition Waste Management Credit - **Option 2**.

7. Occupant Health

The Occupant Health category focus on indoor air quality and thermal, visual comfort. Buildings with good indoor environmental quality protect the health and comfort of building occupants. High-quality indoor environments also enhance productivity, decrease building sickness syndrome and improve the building's value. This category addresses the integrated design strategies and environmental factors that influence the way people learn, work, and live.

7.1. Tobacco Smoke Control

7.1.1. Intention

To prevent or minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke.

7.1.2. Recommended best practice

Prohibit smoking inside the building, and;
Prohibit smoking outside the building except in designated smoking areas located at least 7.5 meters from all entries, outdoor air intakes, and operable windows. Signage must be posted within 3 meters of all building entrances indicating the no-smoking policy.
For residential units, weather-strip must be applied for exterior doors and operable windows to minimize leakage from outdoors [1].

7.1.3. References

[1] - LEED v4 BD+C - **Environmental Tobacco Smoke Control Prerequisite**.

7.2. Indoor Air Quality

7.2.1. Intention

To prevent or minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke.

7.2.2. Recommended best practice

Meet the requirements for both strategy below:

Strategy A. Minimum fresh air supply [1].
Provide fresh air supply to a minimum of 95% of the occupied area of the building, denpend on the ventilation mode:

- Mechanically ventilated spaces: HVAC systems and distribution ductwork must meet the requirements on ventilation rates of one of the following standards:
  - TCVN 5687:2010 - Ventilation - Air Conditioning, Design Standards;
  - ASHRAE 62.1-2010 - Ventilation for Acceptable Indoor Air Quality.
- Naturally ventilated space: meet the requirements of **Credit HVAC - Strategy A. Natural Ventilation**.

Strategy B. Filtration [2].

- Install air filters on fresh air intake with Minimum efficiency reporting value (MERV) of 13 or higher (or Class F7 or higher as defined by CEN Standard EN 779–2002); And:
- Install permanent entryway systems at least 3 meters long in the primary direction of travel to capture dirt and particulates entering the building at regularly used exterior entrances.

7.2.3. References

[1] - LOTUS v3 NC - Ventilation for indoor air quality Credit - **Strategy A**;
[2] - LEED v4 BD+C - Enhanced Indoor Air Quality Strategies - **Option 1**.

7.3. Thermal Comfort

7.3.1. Intention

To promote occupants' productivity, comfort, and well-being by providing quality thermal comfort.

7.3.2. Recommended best practice

Meet both following requirements for at least 95% occupied spaces [1]:

Air-conditioned spaces.
Demonstrate that the number of unmet load hours during the occupied cooling period will not exceed 2% of the occupied hours. Unmet load hours could be calculated by using whole building energy simulation.

Non-air-conditioned spaces.
At design conditions, indoor operative temperature of the spaces should be within the 80% acceptability limits given in Figure below of ASHRAE 55-2010.

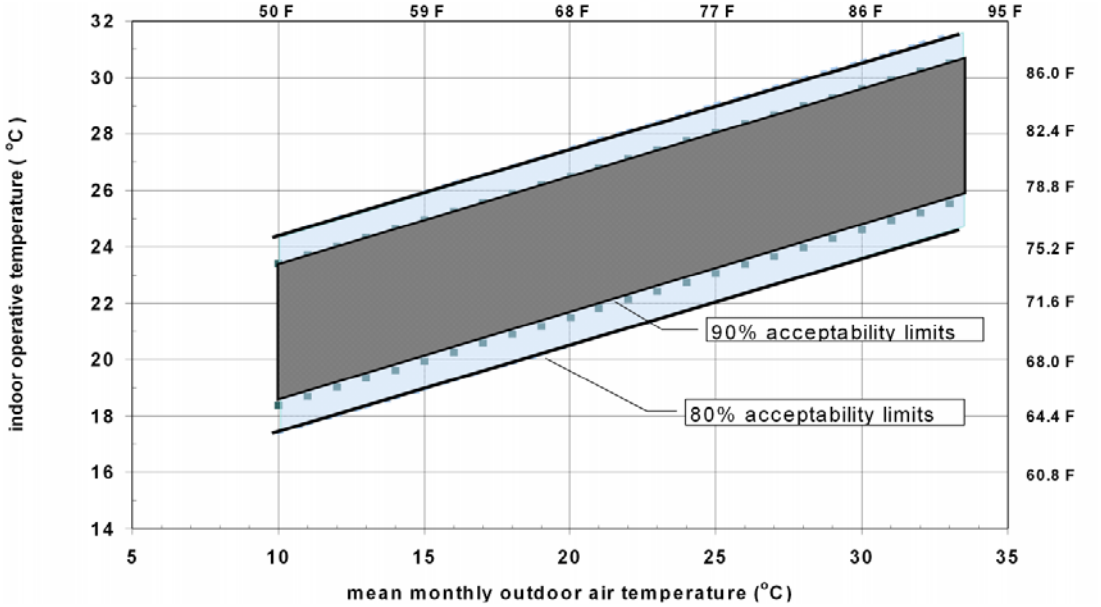


Figure. Acceptable operative temperature ranges for non-air-conditioned spaces.

7.3.3. References

[1] - LOTUS v3 NC - Thermal Comfort Credit.

7.4. Daylighting

7.4.1. Intention

To connect building occupants with the outdoor sources, and reduce the use of electrical lighting by enhancing daylight into the space.

7.4.2. Recommended best practice

Use daylighting simulation to demonstrate one of the following requirements [1]:

- **Spatial daylight autonomy:** $sDA_{300/50\%} \geq 55\%$;
- **Illuminance**: illuminance levels will be between 300 lux and 3,000 lux for 9 a.m. and 3 p.m., both on a clear-sky day at the equinox, for over 75% of the total occupied floor area.

7.4.3. References

[1] - LEED v4 BD+C - Daylight Credit - Option 1 & 2.

7.5. Quality Views

7.5.1. Intention

To give building occupants a connection to the natural outdoor environment by providing quality views.

7.5.2. Recommended best practice

75% of all occupied floor area must have both of the following kinds of views [1]:

- Multiple lines of sight to vision glazing in different directions at least 90 degrees apart;
- Views that include at least one of the following: (1) flora, fauna, or sky; (2) movement.

7.5.3. References

[1] - LEED v4 BD+C - Quality Views Credit.

8. Site Safety

Most accidents can be prevented by taking simple measures or adopting proper working procedures. This category is intended to outline important issues on safety and health that should be paid attention to on construction sites for easy reference by the workers. If project teams work carefully and take appropriate safety measures, there will definitely be fewer work injury cases, and the site will become a safe and secure place to work in.

8.1. EHS

8.1.1. Intention

- To manage health and safety risks in our workplace by implement the HSE Plan for all construction activities.

8.1.2. Recommended best practice

Create and implement the Health, Safety and Environment (HSE) Plan that indicates the following items to limit risks arising from construction activities [1]:

- Managing safety and health on construction sites
  - Organizational structure of HSE team
  - Risk assessment
  - Training program
- Organising the site
  - Planning the work
  - Organising the work
  - Common facilities to be provided: Site access, Site boundaries, Public safety, Lighting, Site tidiness, Storage areas, Fire Safety
- Excavations
- Working at height
  - General provisions
  - Guard rails
  - Safe working platforms
  - General access scaffolds
  - Safe use of access ladders
  - Stepladders
  - Care of ladders
  - Roof works
- Moving, lifting and handling loads
  - Manual handling
  - Hoists
  - Lifts
  - Mobile cranes

- Site vehicles and mobile plant
- Chemicals
- Protective equipment
  - Safety helmet
  - Footwear
  - Goggles and safety spectacles
  - Gloves and protective clothing
  - Other protective equipments
- Emergency procedures
  - Transport

8.1.3. References

[1] - Health and Safety in Construction - Health and Safety Executives (HSE) Books.

9. Contractor Management

Through onsite contractors's activities management, this category promotes environmental protection measures that reduce construction project disturbances and airborne pollutants to neighboring properties, and the site itself.

9.1. Construction Activity Pollution Prevention

9.1.1. Intention

To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation, and airborne dust.

9.1.2. Recommended best practice

Create and implement the Erosion and Sediment Control Plan (ESC Plan) that bases on the following requirements to limit pollution arising from construction activities [1]:

- Erosion and sedimentation control
  - Providing natural buffers from water bodies
  - Installing perimeter controls
  - Minimizing sediment track-out
  - Controlling discharges from stockpiled sediment or soil
  - Minimizing dust
  - Minimizing the disturbance of steep slopes
  - Preserving topsoil
  - Minimizing soil compaction
  - Protecting storm drain inlets
  - Maintaining control measures
- Pollution prevention
  - Prohibited discharges
  - General maintenance requirements
  - Emergency spill notifcation
  - Fertilizer discharge restriction

9.1.3. References

[1] - LEED v4 BD+C - Construction Activity Pollution Prevention Prerequisite.

9.2. Construction Indoor Air Quality Management

9.2.1. Intention

To promote the well-being of construction workers and building occupants by minimizing indoor air quality problems associated with construction.

9.2.2. Recommended best practice

Create and implement an Indoor Air Quality (IAQ) management Plan for the construction and

pre-occupancy phases of the building. The plan must address all of the following requirements from **Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines** [1]:

- HVAC protection.
  - Seal all ductwork, registers, diffusers, and returns with plastic when stored on site or not in service. Seal unfinished runs of ductwork at the end of each day;
  - Do not store materials in mechanical rooms, to reduce potential debris and contamination to mechanical systems;
  - If permanently installed HVAC system must be used during construction, install filtration to protect the indoor environment. Replace these filters regularly during construction and before occupancy;
- Source control.
  - Use low-toxicity and low-VOC materials to the greatest extent possible;
  - Develop protocols for the use of any high-toxicity materials. Isolate areas where high-toxicity materials are being installed and use temporary ventilation for that area;
  - Prevent exhaust fumes (from idling vehicles, equipment, and fossil-fueled tools) from entering the building;
  - Enforce the no-smoking job site policy;
  - Protect stored materials from moisture because absorbent materials exposed to moisture during construction can mold and degenerate long after installation. Store materials in dry conditions indoors, under cover, and off the ground or floor;
  - If materials are improperly exposed to moisture, replace the material and consider testing air quality before occupancy to make sure no mold contamination has occurred.
- Pathway interruption.
  - Isolate areas of work to prevent contamination of other spaces, whether they are fnished or not. Seal doorways, windows, or tent off areas as needed using temporary barriers, such as plastic separations. Provide walk-off mats at entryways to reduce introduced dirt and pollutants.
  - Use dust guards and collectors on saws and other tools.
- Housekeeping.
  - Maintain good job site housekeeping on a daily basis. Use vacuum cleaners with high-efficiency particulate filters and use sweeping compounds or wetting agents for dust control when sweeping.
  - Keep materials organized to improve job site safety as well as indoor air quality.
- Scheduling.

- Keep trades that affect IAQ physically isolated on site and separated from each other by the construction schedule. For example, schedule drywall finishing and carpet installation for different days or different sections of the building.
- Install absorptive-finish materials after wet-applied materials have fully cured whenever possible. For example, install carpet and ceiling tile after paints and stains are completely dry.

9.2.3. References

[1] - LEED v4 BD+C - Construction Indoor Air Quality Management Plan **Credit**.

10. Community Engagement

Awareness of climate change and other environmental concerns is still relatively low in Vietnam and there is still a lot of work to be done to increase public awareness and environmentally friendly behavior. Green buildings should not only implement sustainable design and construction practices but also should help to educate community members and encourage them to change their behaviors. It is also vital that the sustainability is passed on to buildings users, managers and neighborhood so that the building's design features are understood and used, ensuring the intended performance goals are met throughout the life of the building.

10.1. Green Awareness

10.1.1. Intention

To promote awareness and knowledge about sustainability issues in the community.

10.1.2. Recommended best practice

Meet the requirements for both following strategies:

Strategy A. Provide a Building User's Guide for occupants [1].

Strategy B. Implement one of the following items to raise awareness on sustainability [2]:

- Provide signs and/or displays to demonstrate the project's green features;
- Organize regular Green activities and events.

10.1.3. References

[1] - LOTUS v3 NC - Green Awareness **Prerequisite;**
[2] - LOTUS v3 NC - Green Awareness **Credit**.