ARZ
BUILDING RATING SYSTEM

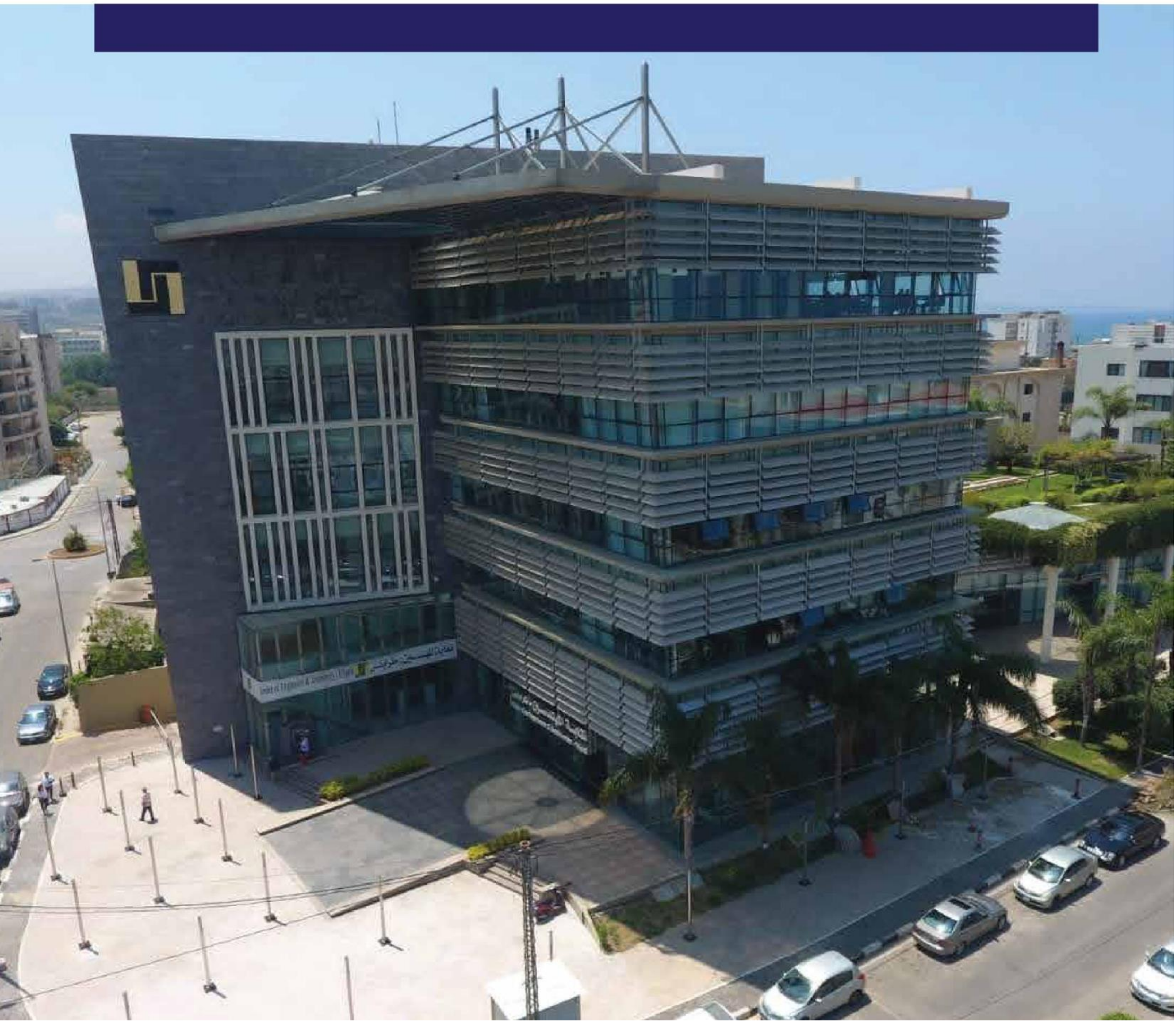
LGBC
lebanon green building council
مجلس لبنان للأبنية الخضراء

UNDP

FUNDED BY THE EUROPEAN UNION

ARZ 2.0 GUIDELINE
For Sustainable New & Existing Buildings

دليل أرز 2.0
للمباني المستدامة الجديدة والقائمة



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ARZ 2.0 GUIDELINE for Sustainable New & Existing Buildings

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Lead authors
Dr. Eng. Riad Assaf (Chair, riadassaf@hotmail.com)
Eng. Emil Hanna (Member, ehanna@assetmanagers.me)
Eng. Rami Tarabay (Member, ramitarabay_11@live.com)
Eng. Riad El Abed (Member, riad_abed@hotmail.com)

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August 2022

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- By email: info@lebanon-gbc.org

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4. Acknowledgments

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5. Introduction

ARZ 2.0 GBRS (Green Building Rating System) is a comprehensive assessment tool that quantifies the performance of buildings.

Whether your building sector is Residential, Office, Hotel, Hospital, Mall, Educational Facility or Mixed use, ARZ 2.0 GBRS offers bankable reports that evaluate how much economy in natural resources (i.e. energy, water, etc.) your project is contributing to the planet during its life cycle whether in design, construction or operation phase.

ARZ 2.0 GBRS offers trustworthy reports to enhance the CSR (Corporate Social Responsibility) of a business.

ARZ 2.0 GBRS is a friendly tutorial and a guide for the Architects and Engineers to optimize their design procedures. It is a one-stop source for Architecture and Engineering students to gain experience and raise their projects' level.

ARZ 2.0 GBRS can act as a TPA (Third Party Assessor) for a fair and impartial building project evaluation.

Section 6 of this guideline presents the ARZ 2.0 GBRS (Green Building Rating System).
Section 7 explains the requirements of the Site Module.
Section 8 explains the requirements of the Materials Module.
Section 9 explains the requirements of the Water Module.
Section 10 explains the requirements of the Wellness Module.
Section 11 explains the requirements of the Energy Module.

Download a free copy of this guideline from
Sign up to ARZ 2.0 GBRS platform through

6. ARZ 2.0 Green Building Rating System

6.1 ARZ 2.0 GBRS Product vision

The LGBC product ARZ 2.0 GBRS (Green Building Rating System) aims to promote 'Sustainable living in a sustainable environment'.

6.2 ARZ 2.0 GBRS Motto

BUILDING A GREENER TOMORROW
Green Buildings · Smart Cities · Healthy Communities

6.3 ARZ 2.0 GBRS Product mission

The LGBC product ARZ 2.0 GBRS purpose is to help community individuals:

- To understand the basic requirements for a sustainable living in a sustainable environment using multiple means of communication.
- To give guidelines for a proper building design that responds to above basic requirements.
- To give guidelines how to construct above building respecting the basic requirements.
- To assure safety and healthy space for the people who occupy the building.
- To propose objective metrics to evaluate how much the building responds to sustainability requirements.

To help understand, design, construct, occupy and evaluate building sustainability through the five elements of Nature:

- 1st element: Cosmos, Ether or Space. Building should be harmoniously integrated in its environment, minimize its impact and make use of the different cycles of Nature.
- 2nd element: Earth. Building should optimize the use of raw materials, support product regeneration and circular economy.
- 3rd element: Water. Building should strive to preserve this precious resource through many recycling technologies.
- 4th element: Fire. Building should target net-zero energy status through implementation of energy conservation, energy efficient and renewable energy systems.
- 5th element: Air. Building should preserve the occupant's wellbeing, providing a healthy environment to work and live.

6.4 ARZ 2.0 GBRS Product philosophy

ARZ 2.0 GBRS is a comprehensive tool that educates users on how to seek living in a sustainable environment. Notably, it raises awareness about circular economy principles as well as many technologies that have positive impact on clean energy transition; whether by applying energy efficiency measures or by relying on renewable energy sources.

In this context, ARZ 2.0 GBRS will help:

1- Increase the demand for Green solutions, hence related jobs (i.e. in EE, RE, etc.).
2- Decrease the primary energy demand in fossil fuel; hence reduce the financial and economic burden on both macro and micro levels.
3- Facilitate access to several financial mechanisms once the building obtains an official rating.
4- Create a platform where different green technologies enterprises and organizations can discuss, meet and develop linkages among them.

6.5 ARZ 2.0 GBRS Methodology

To boost respecting the five elements of Nature, a set of less than 120 criteria will describe the requirements for new (both design and construction phases) and existing buildings among six sectors: residential, office, hotel, hospital, mall and educational facility.

That makes the equivalent of 18 different applications (i.e. new office in design phase, existing hotel, etc.), which have dedicated requirements for each criterion.

When a project is composed of a mixed use, each application will be treated separately.

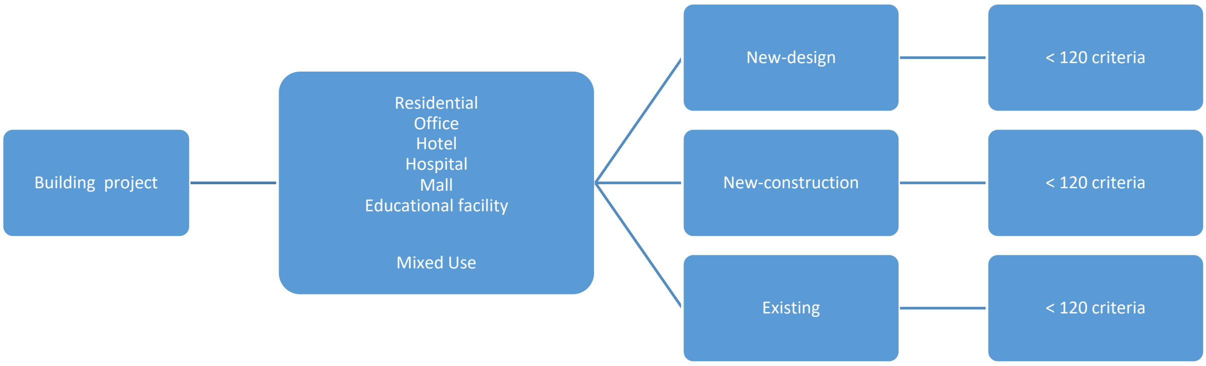


Figure 1. The 18 building applications

Five modules (site, materials, water, wellness and energy) representing the five elements of Nature, as described in Table 1 will help evaluate each application. The latter grade is a weighted average of the five modules grades. The weighted average depends on the application. The bigger the weight is, the more important the module is for a specific kind of building application.

Table 1. Nature element vs Module name

Nature element name	Module name
1st element: Cosmos, Ether or Space	Site
2nd element: Earth	Materials
3rd element: Water	Water
4th element: Fire	Energy
5th element: Air	Wellness

A module listed in Table 1 is subdivided into several families gathering a group of relevant criteria. There will be no more than 120 criteria per building status (existing, new-design, new-construction) spread among the five modules to describe the design, the construction and the functionalities of each type of the defined 18 kinds of building applications. Depending on the latter, the module grade will be a weighted average of the criteria grades that it contains.

The criterion grade is a function of multiple parameters which values are data-entry based. The number of parameters easily reaches 50 for one criterion. Each data-entry is subject to predefined conditions: a) a numerical entry belongs to a specific interval; b) an alphanumeric entry belongs to a specific set of values (i.e. as many as 20 different values for one entry).

In case the user requires a certified rating for the building, he/she should be able to prove that all the parameters are correct. An assessor, certified by LGBC, will review the presented documentation then produce the certified rating. Should the user fail to submit the documentation, or simply doesn't want a certificate, he/she will still be able to get a free online rating.

Whether the user chooses an online rating or a certified rating, he/she can generate a report that shows all the earned criteria grades, the modules and the building grades. On top of that, it will provide suggestions for those who wish to increase their building rating level.

For the sake of consistency, the development of ARZ 2.0 GBRS followed a specific sequence: According to the building application (one of 18 aforementioned options):

1- Describe the criteria per module.
2- Grade each criterion per module.
3- Weigh each criterion in the module.
4- Grade each module, considering the covered criteria grades and weights.
5- Weigh each module, considering the building application.
6- Grade the building, considering the modules grades and weights.
7- Compute the Building Rating Grade, which is the minimum value between the above Building Grade from one side, and from the other side, the sum of 20 + the minimum of the five modules grades.
8- Rate the building.

Building rating levels are described in Table 2.

Table 2. Building Rating Grade vs Building Rating

Building Rating Grade	Building Rating
00 to 49	Uncertified
50 to 59	Certified
60 to 69	Bronze
70 to 79	Silver
80 to 89	Gold
90 to 100	Platinum

6.6 '*Hire an Expert*' Process description

Stakeholders might not have enough time or expertise in order to have a reliable ARZ 2.0 rating. They have the possibility to ask for the help of expert(s) to enter correct data and upload the needed documentation in view to have an online rating then apply for a certified ARZ 2.0 rating from LGBC.

When choosing the option '*Hire an Expert*' from the portal, stakeholders will be directed to a page where certified experts are listed. The list contains photos of the experts, under which this information is displayed:

- Salutation, First name, Last name
- Main relevant occupation
- Expert in the following Modules: (tick what applies) All, Site, Materials, Water, Wellness, Energy

By clicking on the photo, stakeholders are redirected to a page specific to the expert where more information is displayed. *i.e.* email (hyperlinked with the option of choosing pre-set subjects), mobile, short bio, CV (by downloading a pdf file). A sample contract will also be available for the user to download.

6.7 Expert's fees

The contractual relation between the stakeholder and the expert(s) is specific to the project under evaluation and the related workload incurred. It is up to these two parties to agree on the fees, taking into consideration the prevailing complexities.

The stakeholder would hire one expert for the whole project or several experts, one for specific criteria / module. In all cases, a minimum charge of four criteria is applicable.

That being said, LGBC suggests the below scheme for a typical building up to 2,500m^2 of total built-up area.

Table 3. Suggested Expert's fees as on July 12, 2022

Description	**Suggested fees (LBP)**
Per criterion (minimum charge applies)	750,000
Minimum charge	3,000,000
Site module	8,000,000
Materials module	5,000,000
Water module	5,000,000
Wellness module	8,000,000
Energy module	10,000,000
Whole project	30,000,000

6.8 'ARZ 2.0 GBRS Certification' Process description

Getting an official ARZ 2.0 rating of a building, or simply, certification is the ultimate step of a project assessment as a green, eco-friendly, economic and healthy building to live in, work in or visit.

Follow these steps in order to have your project ARZ 2.0 GBRS certified:

1- Sign up/in to ARZ 2.0 web portal, click here
2- Create a new project then enter the related data into all the possible criteria pages.
3- Get an *'Online Evaluation'*.
4- Click on *'Do Better'* button to know how to improve your rating until you are satisfied with your online assessment.
5- In case you did not upload yet the required submittals, go to the *'Attachments'* tab to complete this step to be entitled for an official review by an assessor accredited by LGBC. Click here to visit ARZ 2.0 accredited assessors list.
6- Click on *'Submit for Assessment'* for an official ARZ 2.0 GBRS rating. The portal will check whether all the criteria are marked as *'Done'* and the attachments uploaded before moving forward.
7- Once the submittal is accepted, you will be able to view your project, but editing will be impossible. Nevertheless cloning your submitted project is allowed.
8- Then, LGBC will contact you to appoint the assessor and instruct how to pay the fees. Note that ARZ 2.0 GBRS assessor shall not have any common interest with the project's team. On the contrary, this is not the case for any appointed expert who is considered as part of the project's team.

6.9 LGBC Assessment's fees

The contractual relations between the stakeholder, the LGBC and ARZ 2.0 assessor are specific to the project under evaluation. The contracts define the rights and obligations of each party.

The assessment fees are defined hereafter, they vary according to the building status that the procedure begins with. These fees are directly paid to LGBC that will be in charge to settle the assessor's dues.

Table 4. Suggested LGBC Assessment's fees as on July 12, 2022

Description	**Fixed fees (LBP)**	**excluding parking Variable fees (LBP/m^2)**	**Validity**
Project registration	5,000,000	N/A	1 year
New building starting at:			
Design phase	30,000,000	2,500	2 years
Then, Construction phase	N/A	2,500	3 years
Then, Existing building	20,000,000	4,000	4 years
New building starting at:			
Construction phase	30,000,000	3,500	3 years
Then, Existing building	20,000,000	4,000	4 years
Existing building starting at:			
Existing building	30,000,000	5,000	4 years

7. Module: Site

7.1 Family: Location

7.1.1 Si-1.1: Access to Amenities

7.1.1.1 Criterion Reference and Title

Si-1.1: Access to Amenities

7.1.1.2 Criterion Type

Optional

7.1.1.3 Intent

To encourage an active community lifestyle and to minimize reliance on motor vehicles by choosing to locate the building in an area with a diversity of basic amenities.

7.1.1.4 General Requirements

The project building should be located within a 500-meter safe walking distance from basic amenities. Examples of qualifying basic amenities include the following:

- Supermarket or Grocery Store
- Post Office
- Restaurant
- Pharmacy
- Bank
- Place of Worship (Mosque or Church)
- Medical Center or Dental Clinic
- Day Care Center
- School
- Fitness Center
- Shopping Center
- Police Station
- Beauty Salon
- Hardware Store
- Laundry
- Library
- Senior Care Facility
- Public Park
- Theater
- Community Center.

The safe walking distance is defined as a pedestrian route along dedicated walkways typically provided by a combination of footways (pavement or sidewalks beside carriageways) and dedicated crossing points (traffic lights, stop signs, marked pedestrian crossings or crosswalks). It is measured starting from any building entrance accessible by all occupants and visitors to any entrance of the basic amenities.

Only one basic amenity of each type can be considered for criterion compliance (i.e., 1 restaurant or 1 supermarket). For mixed-use projects, only one basic amenity located within the building can be counted towards this criterion provided it is open to the public. Planned amenities, which are scheduled for opening within one year of the project's completion date can also be counted towards this criterion. However, no more than two planned amenities can be considered.

7.1.1.5 Special Requirements

None

7.1.1.6 Required Submittals

For each stage of the certification review process, submit the supporting documents listed in the table hereunder.

Table 7.1.1-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Plan	● The Site Plan should show the locations of all eligible amenities. Not only should it indicate the safe walking paths from the building entrance to these amenities, but it should also note the specific distances for each route.
Evidence for Planned Amenities (as applicable)	● There should be evidence that the planned amenities will be operational within a year of the project's completion date, at the latest.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Site Plan	● The Site Plan should show the locations of all eligible amenities. Not only should it indicate the safe walking paths from the building entrance to these amenities, but it should also note the specific distances for each route.
Evidence for Planned Amenities	● There should be evidence that the planned amenities will be operational within a year of the project's completion date, at the latest.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Plan	● The Site Plan should show the locations of all eligible amenities. Not only should it indicate the safe walking paths from the building entrance to these amenities, but it should also note the specific distances of each route.
Evidence for Planned Amenities	● There should be evidence that the planned amenities will be operational within a year of the project's completion date, at the latest.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.1.1.7 Score Allocation

The score for this criterion is determined based on the number of basic amenities located within a 500-meter safe walking distance from the building entrance. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{Number\ of\ Eligible\ Basic\ Amenties}{20}$$

A project earns a score of 100% if the total number of eligible basic amenities is equal to 20.

7.1.2 Si-1.2: Access to Common Transportation

7.1.2.1 Criterion Reference and Title

Si-1.2: Access to Common Transportation

7.1.2.2 Criterion Type

Optional

7.1.2.3 Intent

To encourage an active community lifestyle and to reduce pollution emanating from private motor vehicles in use by ensuring that building occupants and their visitors have an easy access to common transportation.

7.1.2.4 General Requirements

The project building should be located within a 500-meter safe walking distance from one or more stops for the following common transportation modes:

- Public bus lines
- Private bus lines
- Campus bus usable by building occupants and visitors
- Common taxi routes (multiple passengers sharing a common taxi).

Note: A private taxi service, such as Uber or Careem, is not considered an eligible mode of common transportation considering that these companies usually serve only one passenger at a time and do not provide means for ridesharing.

What is considered an eligible common transportation route? An eligible common transportation route is any common transportation route with an average transportation frequency, which does not exceed 30 minutes during weekday working hours (Monday through Friday, 6:00 a.m. to 6:00 p.m.) The transportation frequency is the time measured between two consecutive passages of the bus or taxi on a particular route. Each common transportation route should have a unique destination, which is not covered by other routes; double counting similar routes is not allowed. Private bus lines or campus buses dedicated for transporting employees, students or other building occupants at specified time schedules are not required to meet the 30 minute-average frequency.

The **safe walking distance** is defined as a pedestrian route along dedicated walkways typically provided by a combination of footways (pavement or sidewalks beside carriageways) and dedicated crossing points (traffic lights, stop signs, marked pedestrian crossings or crosswalks). It is measured from any building entrance accessible by all occupants and visitors to the aforementioned stops.

For transportation modes utilizing the "hail and ride" system, any point on this route can be considered an eligible stop for walking distance measurement. "Hail and ride" is a boarding method for public transport. The passenger waves to the driver to stop at any safe location for boarding. This is different from the conventional system, in which the bus only stops at designated locations.

Planned common transportation routes, which are scheduled for launching within a year of the project's completion date, can be counted towards this criterion. However, no more than one planned common transportation route can be considered.

7.1.2.5 Special Requirements

None

7.1.2.6 Required Submittals

For each stage of the certification review process, submit the supporting documents listed in the table hereunder.

Table 7.1.2-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Plan	● The Site Plan should show locations of all eligible common transportation routes and /or stops. Not only should it indicate the safe walking paths from the building entrance, but it should also note the specific distances for each route.
Evidence for Planned Transportation Routes (as applicable)	● There should be evidence that the planned common transportation route will be operational within a year of the project's completion date, at the latest.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Site Plan	● The Site Plan should show locations of all eligible common transportation routes and /or stops. Not only should it indicate the safe walking paths from the building entrance, but it should also note the specific distances for each route.
Evidence for Planned Transportation Routes	● There should be evidence that the planned common transportation route will be operational within a year of the project's completion date, at the latest.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Plan	● The Site Plan should show locations of all eligible common transportation routes and /or stops. Not only should it indicate the safe walking paths from the building entrance, but it should also note the specific distances for each route.
Evidence for Planned Transportation Routes	● There should be evidence that the planned common transportation route will be operational within a year of the project's completion date, at the latest.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.1.2.7 Score Allocation

The score for this criterion is determined based on the number of common transportation routes accessible within a 500-meter safe walking distance from building entrances. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{Number\ of\ Eligible\ Common\ Transportation\ Routes}{5}$$

A project earns a score of 100% if the total number of eligible common transportation routes is equal to 5.

7.1.3 Si-1.3: Preserve or Enhance Ecological Value

7.1.3.1 Criterion Reference and Title

Si-1.3: Preserve or Enhance Ecological Value

7.1.3.2 Criterion Type

Optional

7.1.3.3 Intent

To preserve or enhance the ecological value of the site by conserving existing natural areas or restoring disturbed areas.

7.1.3.4 General Requirements

The ecological value of the site should be preserved or enhanced to promote biodiversity and to provide a habitat for indigenous species. Depending on the site classification, there are two options to consider for criterion compliance:

Option A: Greenfield Site

Preserve and protect at least 25% of the greenfield area on the site from any construction activity. Greenfield refers to any land, which has not been disturbed or developed.

A site ecological assessment should be conducted by a qualified environmental professional prior to the start of the design stage and to any site clearance activities. The purpose of this assessment is to identify the following:

- The valuable natural assets located on-site
- The recommended protection measures for the valuable natural assets
- The potential ecological impacts of the construction and recommended mitigation measures
- The opportunities for site ecological enhancement.

The ecological and environmental components to be considered in the ecological assessment include the following:

- The flora, the fauna, and the habitats
- The topology, the geology, the geotechnical engineering and the hydrology
- The marine and coastal conditions
- The waste and the contamination
- The microclimate, the noise, and the air quality
- The archeological and the cultural heritage features.

An environmental management plan should be developed prior to the start of the construction activities and should incorporate the recommended protection and mitigation measures identified in the ecological assessment. This plan should be implemented by the contractor during the construction stage.

OR

Option B: Previously Developed Site

Restore a minimum of 25% of the total previously developed site area (including building footprint) with native or adapted vegetation. An ecological enhancement plan should be developed by a qualified environmental professional and should address the following:

- The soil enhancement and the protection strategies
- The specification for native or adapted plant species (refer to water module criterion Wa-3.1)
- The planting schedules
- The water efficient irrigation system (refer to water module criterion Wa-3.2)
- The habitat creation
- The landscape management plan (reduced demand for fertilizers and pesticides).

7.1.3.5 Special Requirements

None

7.1.3.6 Required Submittals

For each stage of the certification review process, submit the supporting documents listed in the table hereunder.

Table 7.1.3-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Plan	● The Site Plan should show the protected/restored area.
Site Ecological Assessment Report (Option A)	● The Site Ecological Assessment Report should be provided for greenfield sites.
Landscape Design Drawings (Option B)	● The Landscape Design Drawing should show the total area and all the vegetated zones areas.
List of Plant Species (Option B)	● The List of Plant Species should include native or adapted plants.

New Building in Construction Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Plan	- The Site Plan should show the protected/restored area.
Environmental Management Plan (Option A)	- The Environmental Management Plan should include a description of all the proposed protection measures.
Ecological Protection/ Enhancement Reports	- The Ecological Protection/ Enhancement Reports should document and include photos of all the protection/enhancement measures implemented during construction.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Plan	- The Site Plan should show the protected/restored area.
Ecological protection/ enhancement reports	- These reports should document the protection/enhancement measures implemented during construction.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.1.3.7 Score Allocation

The score for this criterion is determined based on the percentage of the site area, which has been ecologically preserved (Greenfield site) or restored (Previously developed site). In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{Percentage\ of\ Site\ Area\ Preserved/Restored}{50}$$

A project earns a score of 100% if the percentage of preserved/restored area is higher than 50% of the total site area.

7.2 Family: Planning

7.2.1 Si-2.1: Outdoor Areas for Recreation

7.2.1.1 Criterion Reference and Title

Si-2.1: Outdoor Areas for Recreation

7.2.1.2 Criterion Type

Optional

7.2.1.3 Intent

To improve the occupants' quality of life by providing outdoor areas for recreation.

7.2.1.4 General Requirements

Incorporate outdoor recreational areas and make them available and accessible to all building occupants and visitors to entice an active lifestyle and to promote interaction with the environment.

Examples of eligible outdoor recreation areas include

- A courtyard
- A roof
- A terrace
- A podium
- A landscape area
- A playground
- A sport field.

Outdoor recreation areas should

- Be accessible to all building occupants and visitors
- Be located within 60 meters from the building entrance
- Be vegetated at least of 15% (turf grass not included)
- Be vegetated at least 25% of the overall recreation area (turf grass not included)
- Have an unobstructed view of the sky
- Have accessible roof areas, which are safe for occupants (flat surface with guard rails with no fall or trip hazards)
- Not be situated near sources of air contamination (flue-gas stack or exhaust ducts)
- Not be located near sources of noise (i.e., generators, mechanical equipment)
- Incorporate options for shade (i.e., trees or canopies)

- Integrate outdoor seating areas (at least one seating space per 20 m^2).

7.2.1.5 Special Requirements

None

7.2.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.2.1-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Design Plan	● The Site Plan should show the outdoor recreation area and the vegetated area.
New Building in Construction Phase	
Criterion narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site As-built Plan	● The Site As-built Plan should show the outdoor recreation area and the vegetated area.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site As-built Plan	● The Site As-built Plan should show the outdoor recreation area and the vegetated area.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.2.1.7 Score Allocation

The score for this criterion is determined based on the percentage of the outdoor recreation area. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * \frac{Percentage\ of\ Outdoor\ Recreation\ Area}{50}$$

Where:

- F_1 is calculated using the following formula:
  If the Percentage of the Vegetated Area ≥ 25%, $F_1 = 1$
  If the Percentage of the Vegetated Area < 25%, $F_1 = 0$

A project earns a score of 100% if the percentage of outdoor recreation area is higher than 50% of the total site area, and the percentage of the vegetated area is more than 25% of the recreation area. Note that each individual recreation area should have a vegetated area equal to 15% at least.

7.2.2 Si-2.2: Bicycle Racks

7.2.2.1 Criterion Reference and Title

Si-2.2: Bicycle Racks

7.2.2.2 Criterion Type

Optional

7.2.2.3 Intent

To promote an active lifestyle and reduce greenhouse gas emissions by encouraging bicycle use.

7.2.2.4 General Requirements

Include in the design of the project secure on-site bicycle storage spaces and eligible bicycle routes, which include marked bike lanes or any public street with a speed limit less than 40 km/h. These eligible bicycle routes should connect various existing basic amenities (as defined in criterion Si-1.1) within a 5,000-meter cycling distance from the project boundary.

Bicycle storage and shower facilities should be provided as follows

- A Long-term bicycle storage for at least 5% of all regular building occupants (i.e., not less than two storage spaces per building). Long-term spaces are intended for occupants or employees who are expected to use the bicycle storage for more than 4 hours per day.
- A short-term/visitor bicycle storage for every 500m^2 of gross building area (i.e., not less than two storage spaces per building along with the existing long-term bicycle storage spaces). Short-term spaces are intended for visitors who are expected to use the bicycle storage for less than 4 hours per day.
- At least one On-site shower with one changing room and clothes lockers per gender for every 100 regular building occupants (i.e., not less than one shower and one changing room per gender and not more than 10 showers and 10 changing rooms per gender).
- A long-term and a short-term bicycle storage located within a 30-meter walking distance from any building entrance.

The design of bicycle storage spaces should comply with the following:

- Each bicycle space must be at least 2 x 0.75 m.

- A passageway of at least 1.5 meters wide must be provided alongside the bicycle parking to allow bicycle maneuvering.
- Bicycle stands must be permanently fixed to the ground, and must allow both the wheel and the frame of the bicycle to be locked safely to the structure.
- All outdoor bicycle parking spaces must be shaded.
- Clear signage must be installed in case the parking is neither visible from the street nor from the building.

7.2.2.5 Special Requirements

None

7.2.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.2.2-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion
Site Design Plan	● The Site Plan should show the location of the bicycle storage area and its distance from the building entrance.
Location Map	● The Location Map should show each bicycle route to nearby basic amenities, and should indicate each related distance.
Design Drawings	● The Design Drawings should include the bicycle storage area, and the shower facilities.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site As-built Plan	● The Site As-built Plan should show the location of the bicycle storage area, and the distance from the building entrance.
Location Map	● The Location Map should show each bicycle route to the nearby basic amenities, and should indicate each related distance.
As-built Drawings	● As-built Drawings should include the bicycle storage area, and the shower facilities.

Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site As-built Plan	- The Site As-built Plan should show the location of the bicycle storage area, and the distance from the building entrance.
Location Map	- The Location Map should show each bicycle route to the nearby basic amenities, and should indicate each related distance.
As-built Drawings	- The As-built Drawings should include the bicycle storage area, and the shower facilities.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.2.2.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor (WF)**	
Long-Term Bicycle Storage Spaces	WF_1	2
Short-Term Bicycle Storage Spaces	WF_2	2
Showers per Gender	WF_3	1
Changing Rooms per Gender	WF_4	1

The calculator will determine the exact score according to the weighted average score for compliance with the requirements, and the number of basic amenities accessible within a 5,000-meter cycling distance. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * Weighted\ Average\ Score * \frac{Number\ of\ basic\ Amenities}{10}$$

The weighted average score for compliance with the requirements is calculated using the following formula:

$$Weighted\ Average\ Score = \frac{\sum \quad Weight\ Factors\ of\ compliant\ reqirements}{\sum \quad Weight\ Factors\ of\ all\ requirements}$$

A project earns a score of 100% for this criterion by meeting all the requirements, and by having at least 10 basic amenities located within a 5,000-meter cycling distance.

7.2.3 Si-2.3: Sustainable Parking Management Program

7.2.3.1 Criterion Reference and Title

Si-2.3: Sustainable Parking Management Program

7.2.3.2 Criterion Type

Optional

7.2.3.3 Intent

To reduce air pollution associated with fossil-fueled vehicles, and to alleviate the burden of congestion on traffic networks by supporting sustainable commuting strategies.

7.2.3.4 General Requirements

Develop a sustainable parking management program by implementing and encouraging the following strategies:

- Design the project so that the number of provided parking spaces does not exceed the minimum local code requirements by more than 25%.
- Utilize shared parking structures for mixed-use buildings where possible.
- Designate at least 5% of all parking spaces used by the project as preferred parking spaces for either carpooling vehicles, electric vehicles, or hybrid vehicles. "Carpooling is a transport system based on a shared use of private cars. It is an arrangement between people to make a regular journey in a single vehicle, typically with each person taking turns to drive the others."
- Equip half of the preferred parking spaces with electric charging stations (for plug-in electric vehicles).
- Distribute preferred parking spaces proportionally between the spaces dedicated to visitors and spaces reserved for regular building occupants (i.e., employees).
- Preferred parking spaces are those which are optimally located for building access (i.e., closest to building entrances) and are fully shaded. These spaces should be clearly marked as reserved parking spaces for carpooling, electric and hybrid vehicles.
- For paid parking structures, a discounted rate of at least 20% is an acceptable substitute for preferred parking spaces, applicable only for carpooling. However, the 5% reserved parking spaces must still be equipped with electric charging stations, and saved for electric and hybrid vehicles. The discounted rate must be publicly posted at the entrance of the parking area.

A mechanism of enforcement of the aforementioned strategies must be implemented to ensure that access to the preferred spaces is reserved only for eligible vehicles. The selection of the enforcement system is kept at the discretion of the parking operator.

7.2.3.5 Special Requirements

None

7.2.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 7.2.3-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Local Parking Regulations	● The Local Parking Regulations document should specify the minimum required number of parking spaces for the project.
Parking Design Plan	● The Parking Design Plan should show the total number of provided parking spaces.
Design Drawings	● The Design Drawings should show the location of the preferred parking spaces and the electric vehicle charging stations.
New Building in Construction Phase	
Criterion narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Parking Local Regulations	● The Local Parking Regulations document should specify the minimum required number of parking spaces for the project.
Parking As-built Plan	● The Parking As-built Plan should show the total number of provided parking spaces.
As-built Drawings	● The As-built Drawings should show the location of the preferred parking spaces and the electric vehicle charging stations.
Existing Building	

Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Parking Local Regulations	● The Local Parking Regulations document should specify the minimum required number of parking spaces for the project.
Parking As-built Plan	● The Parking As-built Plan should show the total number of provided parking spaces.
As-built Drawings	● The As-built Drawings should show the location of the preferred parking spaces and the electric vehicle charging stations.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.2.3.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor (WF)**	
Total Number of Provided Parking Spaces	WF_1	1
Number of Preferred Parking Spaces	WF_2	1
Number of Electrical Vehicle Charging Station	WF_3	1

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * Weighted\ Average\ Score$$

The weighted average score for compliance with the requirements is calculated using the following formula:

$$Weighted\ Average\ Score = \frac{\sum \quad Weight\ Factors\ (WF)\ of\ compliant\ requirements}{\sum \quad Weight\ Factors\ (WF)\ of\ all\ requirements}$$

A project earns a score of 100% for this criterion by meeting all the requirements.

7.2.4 Si-2.4: Heat Island Effect Reduction

7.2.4.1 Criterion Reference and Title

Si-2.4: Heat Island Effect Reduction

7.2.4.2 Criterion Type

Optional

7.2.4.3 Intent

To reduce the heat island effect, and to improve the microclimate conditions by an appropriate building design and selection of materials.

7.2.4.4 General Requirements

Heat islands are urbanized areas which experience higher temperatures than their surroundings. It is mainly due to solar radiation absorption by building envelopes, hardscapes, and asphalt roads, which cause surface temperature and ambient temperature to rise within these areas.

In order to minimize the contribution of the project to the heat island effect, there are several measures, which can be implemented to reduce the overall heat absorption of the site.
These measures comprise the following:

- The installation of shading structures (for hardscapes and outdoor parking) covered by either of the following:
  - Materials with initial solar reflectance (SR) of at least 0.33
  - Renewable energy generation systems, such as solar thermal collectors or photovoltaic panels
  - Vegetation (artificial turf is not acceptable)
- The installation of paving materials with initial solar reflectance (SR) of at least 0.33
- The use of paving materials which are less than 50 % impervious, and which contain vegetation in the open cells.
- The cultivation of plants or trees which provide shade over hardscape areas within 10 years of planting.
- The use of roofing materials which have an initial SRI equal to or greater than the values in the table hereunder.

	Slope	Initial SRI
Low-sloped roof	≤ 1:6	82
Steep-sloped roof	> 1:6	39

- The installation of a vegetated roof (artificial turf is not acceptable)

Solar Reflectance

The "Solar Reflectance or Reflectivity (SR) is the ability of a material to reflect solar energy from its surface back into the atmosphere". It is measured on a scale of 0 to 1.0. A value of 0 indicates that the material has a full absorption ability of the solar energy, whereas a value of 1.0 indicates a total reflectance ability of the solar energy.

Solar Reflectance Index

The Solar Reflectance Index (SRI) measures the ability of a material to stay cool in the sun by reflecting solar radiation and emitting thermal radiation. It incorporates both solar reflectance and thermal emissivity in a single value. Emissivity is a material's ability to release absorbed energy.

SRI is calculated according to ASTM E 1980 and is measured on a scale of 0 to 100. Materials with high radiation absorption and retention are granted a lower score on the scale. However, highly reflective materials are granted a higher score on the scale. "It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100."

7.2.4.5 Special Requirements

None

7.2.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.2.4-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Design Plan	● The Site Plan should show the areas covered by materials which comply with the criteria requirements.

Roof Plan	- The Roof Plan should show the areas covered by materials which comply with the criteria requirements.
Design Specifications	- The Design Specifications should include specifications of materials covering shading structures, pavements, roofs, and vegetation.
New Building in Construction Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site As-built Plan	- The Site As-built Plan should show the areas covered by materials which comply with the criteria requirements.
Roof As-built Plan	- The Roof As-built Plan should show the areas covered by materials which comply with the criteria requirements.
Manufacturer Datasheets	- The Manufacturer Datasheets should be provided for materials covering shading structures, pavements, roofs, and vegetation.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site As-built Plan	- The Site As-built Plan should show the areas covered by materials which comply with the criteria requirements.
Roof As-built Plan	- The Roof As-Built Plan should show the areas covered by materials which comply with the criteria requirements.
Manufacturer Datasheets	- The Manufacturer datasheets should be provided for materials covering shading structures, pavements, roofs, and vegetation.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.2.4.7 Score Allocation

The score for this criterion is determined based on the percentage of the site area, which is covered by reflective materials, vegetation, or renewable energy systems. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{Percentage\ Covered\ Site\ Area}{100}$$

The score is equal to the percentage of the covered site area (i.e., if the covered area is only 30% of the site area, the total score achieved in this criterion will be: 100 * $\frac{30}{100}$ = 30%).

7.2.5 Si-2.5: Passive Design Strategies

7.2.5.1 Criterion Reference and Title

Si-2.5: Passive Design Strategies

7.2.5.2 Criterion Type

Optional

7.2.5.3 Intent

To support a proper effective passive design as an approach to minimize energy consumption, to reduce operating and maintenance costs, and to enhance the occupants' well-being and comfort.

7.2.5.4 General Requirements

To identify the best Passive Design Strategies for the project with relevance to Lebanon's climate zone characteristics. To respect the bioclimatic chart for passive design strategies.

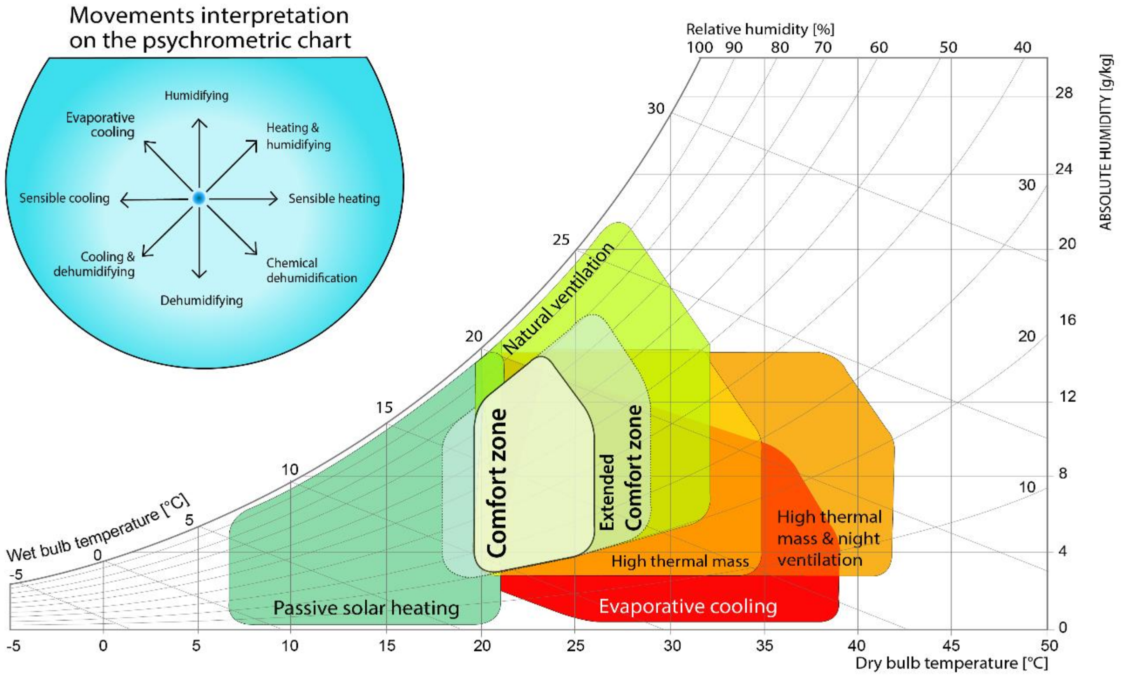
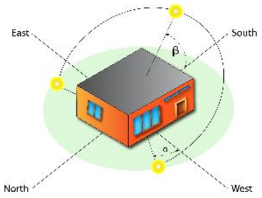
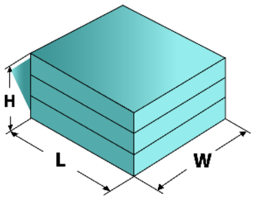
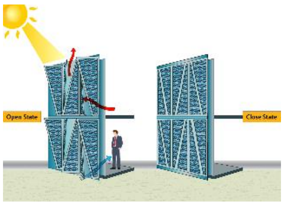
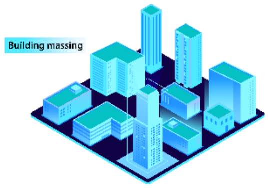
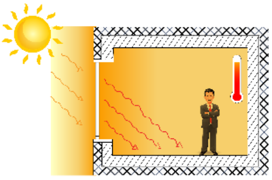
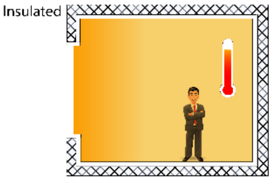
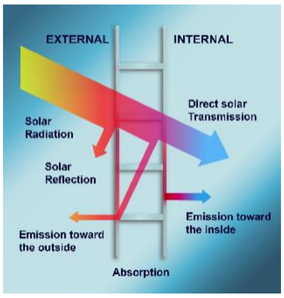


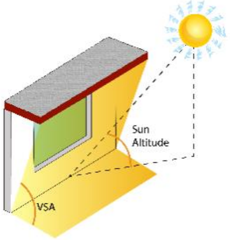
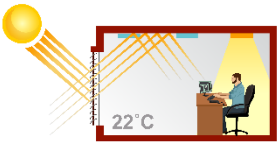
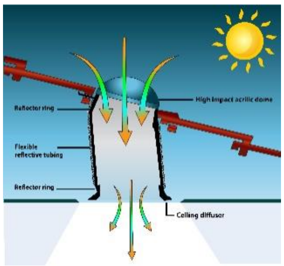
Figure 7.2.5-1 Bioclimatic Chart for Passive Design Strategies

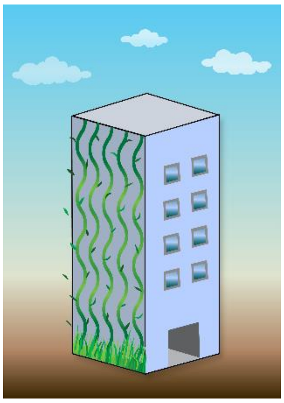
The bioclimatic chart assists (1) in developing a holistic understanding of any climate and its influence on thermal comfort, (2) in suggesting design methods for adapting architecture to climate, and (3) in identifying an appropriate cooling or heating strategy based on outside climatic conditions. Passive Design Strategies can be classified as per the following table.

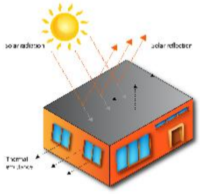
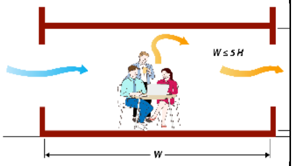
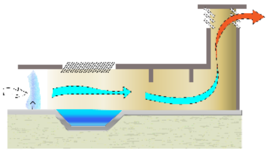
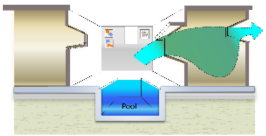
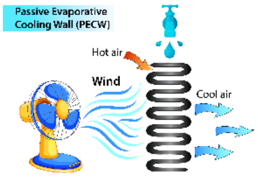
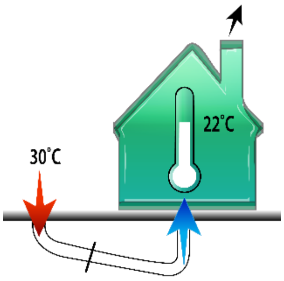
Table 7.2.5-1 Passive Design Strategies

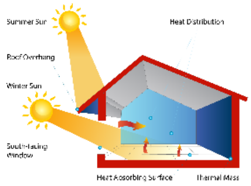
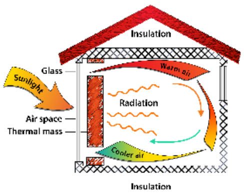
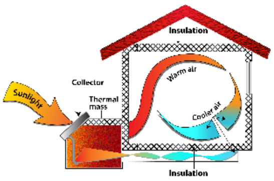
Passive Design Strategy		Description
Orientation		The amount of sun lighting on surfaces, daylighting, and wind direction are all affected by site planning and building orientation decisions. Towards net zero energy objective, shape and orientation have a major effect on a building's energy efficiency; thus, allowing to take full advantage of the sun and prevailing winds. The designer must prioritize all the aforementioned factors and site conditions, which have a major impact on how the building should be oriented considering the overall local climate.
Shape		Heating and cooling requirements may vary depending on the shape of the building. The more compact the shape is, the less heat is wasted. The architectural design should be compact in both hot/dry areas and cold climates to minimize the thermal gain and loss respectively. A design which keeps corners and joints to a minimum minimizes the potential of generating thermal bridges, which allow heat to flow outside.
Skin		Using adaptive solar skin and Kinetic skin with the goal of increasing the building's overall performance. It is a new generation of façade designs, which is multifunctional and highly adaptive, integrating functions, features, and behavior which can change over time in response to environmental and operational requirements.

Building Massing		Building massing, which determines the structure's shape and size, is an essential component of the design process. The overall shape and dimensions of the building need to be adequately determined to optimize its free energy from the sun and wind while reducing its energy loads. During the design phase, three important factors in building massing should be considered: passive heating, cooling, and daily lighting.
Thermal Mass		Thermal mass may be utilized successfully to collect solar heat in the winter to maintain a suitable room temperature and reflect it back into the room at night to provide warmth. In summer, in regions with high thermal mass, buildings should be shaded from the sun or should be land-shaded to benefit from cooling breezes, thus preventing them from overheating.
Insulation		The benefits of Insulation. The insulation stands as a power barrier. While insulation resists fire, reduces noise and controls moisture, it undeniably prevents excessive thermal energy loss by reducing energy consumption needs. The thermal transmittance, also known as U-value, of the walls and the roof must be carefully selected in accordance with the climate zone. It is essential to reduce thermal bridges.
Glazing Performance		One of the most efficient ways to harness solar gain and minimize energy loss is through window techniques. If special attention is given to windows and shades, winter sun could be maximized without running the risk of overheating in summer. The solar aspects of windows should be balanced with natural daylight and view concerns. U-value and Shading Coefficient "SC" must be carefully selected according to the climate zone.

Shading		There are many kinds of external shading methods, some of which are listed hereunder: ● Solar screens ● Shutters ● Vertical louvers/fins ● Roll-down blinds ● Horizontal louvers/fins ● Egg-crate shading devices ● Canvas awnings (fixed or moveable).
Daylighting	 	Daylighting is a passive lighting method to benefit from the sunlight as much as possible, and to minimize the usage of artificial lighting fixtures. There are many kinds of daylighting systems, such as skylights, clerestories, light wells, light ducts, reflectors, atria, roof monitors, saw-tooth roofs, and solar tubes. A systematic intelligent approach to using daylight should start by ● selecting the orientation of the building and devising ways to use the shade, the shutters, the blinds, and the sun protection. ● finding the right selection of specific glazing to reduce the heat and to control solar gains. ● opting for adequate window sizes and their location based on the use of the space and its proportion ● using reflecting materials with light colors ● redistributing daylighting by reflection usage ● using indoor and outdoor glare controls.
Vegetation		Vegetation placement, species selection and adequate maintenance may be helpful to benefit from wind-driven ventilation and solar orientation. Vegetation may naturally shade the building. Air flow patterns may be controlled and modified by vegetation, landscape, and building massing. This disposition contributes to the achievement of comfortable temperatures in cold climates, and of cooling breezes in hot and humid climates.

Green Façade		Leafy green façades offer the appropriate amount of shade during the warmer months of the year while allowing the right amount of sunlight and heat to enter the building during the colder months. Not only does vegetation reduce the area temperature by 1-2°C owing to the evaporation process, but it also emits oxygen, which improves the quality of the air. Additionally, the leafage filters out debris and protects the façade from the weather impacts.
Green Roof		Green roofs have a wide spectrum of benefits, too. In fact, they ● Enhance the overall look of a building ● Reduce storm water runoffs ● Attenuate indoor heat significantly ● Guarantee roof waterproofing ● Bind dust and pollution ● Produce oxygen ● Decrease noise. The evaporation of the moist soil and plants also cools the building environment by reducing the local temperature. Studies have shown that green roofs outperform white or reflecting roofs in lowering the temperature of the surrounding air. Green roofs have also proven to ● Reduce storm water runoffs ● Decrease the yearly runoff volume ● Lower the peak runoff rate. A green roof must be designed to serve the aforementioned purposes.

Cool Roof		A cool roof outperforms a conventional one in terms of reflecting more sunlight, absorbing less heat, and minimizing the heat island effect. A cool roof, which can be made of highly reflective tiles or a certain type of paint, or a sheet covering, is designed primarily in view of the local climate and other factors.
Natural Ventilation		The main categories of natural ventilation techniques are ● Single-sided ventilation, single opening ● Single-sided ventilation, double opening ● Cross ventilation single-banked space ● Cross ventilation double-banked spaces ● Stack ventilation (e.g., Wind Towers, Wind Scoops).
Passive Cooling	   	**A) Cooling by Ventilation** **1. Comfort ventilation:** A day-and-night ventilation to improve skin evaporation and thermal comfort. **2. Night-flush cooling:** A ventilation method to pre-cool the building for the following day. **B) Evaporative Cooling** **1. Direct evaporation:** Water is sprayed into the air within a building to decrease air temperature and increase humidity. **2. Indirect evaporative cooling:** Evaporation cools the incoming air, without increasing the indoor humidity. **C) Earth Cooling** 1. **Direct coupling**: The heat is lost directly into the earth by earth-sheltered buildings. **2. Indirect coupling:** The air flows inside the building via earth tubes.
Passive Heating		The three main categories of Passive Heating are

	  	**a. Direct Gain (Windows/Skylights)** Direct Gain is the simplest solar heating system and the least complex to build. More often than not, the right placement of windows will help achieve the desired result. **b. Indirect Gain (Solar Air Collectors, Thermal Storage Wall)** Thermal storage walls, also known as Trombe walls, consist of two exterior walls, one of which is made of concrete or concrete-filled blocks while the other is made of glass. The solar heat, which is stored in thermal storage walls, radiates into the living space. Solar air collectors capture solar energy, vent out the back of the air collector, then transfer warm air into the space. **c. Isolated Gain (Passive Solar Sunspace)** Sunspaces are rooms, which capture the sun's energy; then the generated heat is radiated into the living space. Sunspaces are comfortable to stay in during much of the year.
Integrated Renewable Energy		**Integrated Renewable Energy** is about adopting and integrating renewable energy sources in building design. Renewable energy is a clean energy derived from finite resources in nature, such as wind, water, and sun, and which is constantly replenished. The types of renewable energy resources for buildings are ● Solar energy (PV and Thermal) ● Wind energy ● Hydro energy ● Geothermal energy ● Biomass energy ● Hydrogen energy (Fuel Cell).

Passive Rain Water Harvesting		Passive water harvesting refers to the practice of retaining runoff water from the catchment area to the holding area, and then storing it to be naturally absorbed by the soil via infiltration for landscape irrigation and groundwater replenishment. It is used for conserving precious water. Passive collection methods include vegetative swales, dry stream beds, and pervious concrete or pavers.

7.2.5.5 Special Requirements

None

7.2.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.2.5-2 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	● The Drawings should show the characteristics of each passive design strategy.
Specifications	● The Specifications of all passive design strategies should be provided.
Calculations / Sizing	● The Calculation and Sizing of passive design strategies and benefits should be provided.
New Building in Construction Phase	
Criterion Narrative	● The updated Criterion Narrative (if different from the Design Phase)
Drawings	● Drawings should show the characteristics of each passive design strategy.
Datasheets	● The Manufacturer Datasheets / Catalogs (if available) should mention the techniques adopted for passive design strategies.
Calculations / Sizing	● The updated Calculations and Sizing of the passive design strategies and benefits should be provided.

Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	● The Drawings should show showing the characteristics of each passive design strategy.
Datasheets	● The Manufacturer Datasheets / Catalogs (if available) should mention the techniques adopted for passive design strategies.
● Calculations / Sizing	● The Calculation and Sizing of passive design strategies and benefits should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents which can provide additional relevant information for the certification reviewers to consider.

7.2.5.7 Score Allocation

The score for this criterion is determined based on the following score allocation table for each criterion requirement.

Table 7.2.5-3 Factors and Weight Factors for Criterion Requirement

Criterion Requirement	**Status**	**Factor "F"**		**Weight Factor "WF"**	
Orientation	Yes	F_1	1	WF_1	1
	No		0		
Shape	Yes	F_2	1	WF_2	2
	No		0		
Skin	Yes	F_3	1	WF_3	1
	No		0		
Massing	Yes	F_4	1	WF_4	2
	No		0		
Thermal Mass	Yes	F_5	1	WF_5	2
	No		0		
Insulation (Wall, Roof)	Yes	F_6	1	WF_6	3
	No		0		
Glazing Performance	Yes	F_7	1	WF_7	3

	No		0		
Shading	Yes	F_8	1	WF_8	2
	No		0		
Daylighting	Yes	F_9	1	WF_9	3
	No		0		
Vegetation	Yes	F_{10}	1	WF_{10}	2
	No		0		
Green Façade	Yes	F_{11}	1	WF_{11}	1
	No		0		
Green Roof	Yes	F_{12}	1	WF_{12}	2
	No		0		
Cool Roof	Yes	F_{13}	1	WF_{13}	1
	No		0		
Natural Ventilation	Yes	F_{14}	1	WF_{14}	3
	No		0		
Passive Cooling	Yes	F_{15}	1	WF_{15}	3
	No		0		
Passive Heating	Yes	F_{16}	1	WF_{16}	3
	No		0		
Renewable Energy	Yes	F_{17}	1	WF_{17}	3
	No		0		
Passive Rainwater Harvesting	Yes	F_{18}	1	WF_{18}	2
	No		0		

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = Min\left\{1.25 *\ 100 * \left[\frac{\left(\sum_{i=1}^{18} \quad F_i * WF_i\right)}{\left(\sum_{i=1}^{18} \quad WF_i\right)}\right], 1\right\}$$

The weight is increased by 25%, which means it is multiplied by 1.25 to encourage adopting passive design strategies. If no passive design strategy is implemented, the score for this criterion will be 0%. A project earns a score of 80% for this criterion if all the aforementioned passive design strategies are implemented in the project.

When a new innovative passive design strategy is introduced, an innovation criterion in the bonus family is granted.

7.3 Family: Pollution

7.3.1 Si-3.1: Night Light Pollution

7.3.1.1 Criterion Reference and Title

Si-3.1: Night Light Pollution

7.3.1.2 Criterion Type

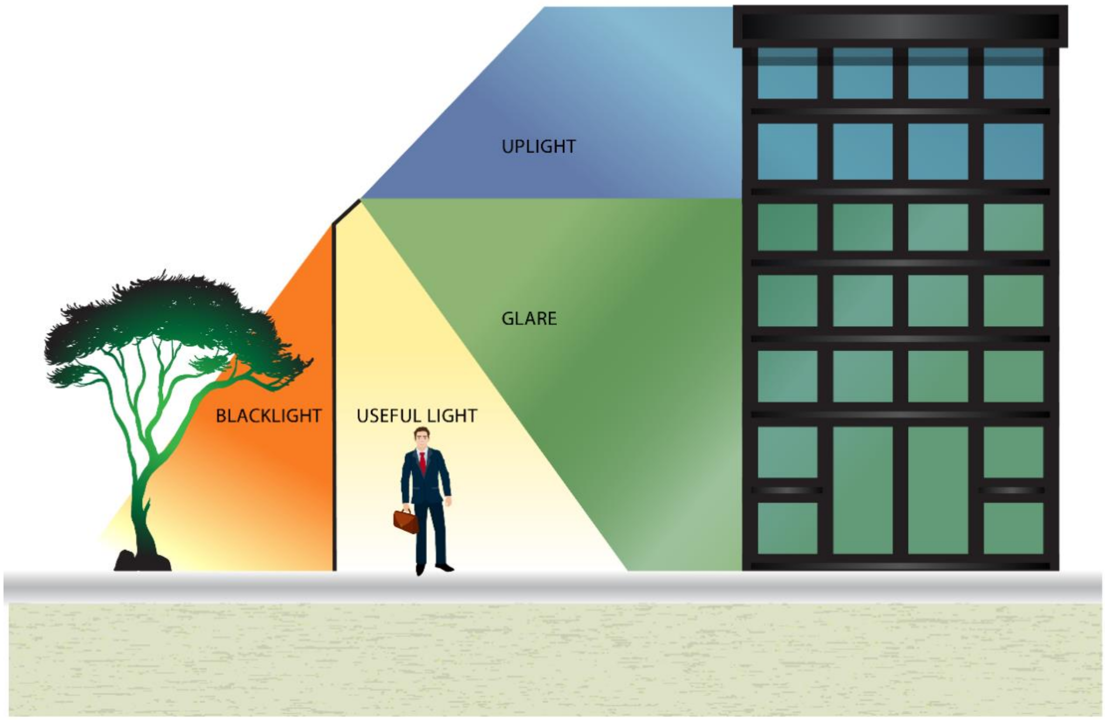
Optional

7.3.1.3 Intent

To minimize light pollution during nighttime, which improves night sky visibility and reduces the impact on nocturnal wildlife and surrounding properties.

7.3.1.4 General Requirements

Light pollution is caused by excessive, misdirected, or obtrusive use of light. Light pollution disrupts night sky clarity, impacts nocturnal ecosystems, and can have negative effects on building occupants' health. In order to reduce the night light pollution, lighting must be concentrated in appropriate areas to minimize upward lighting and obtrusive lighting (backlight and glare).



The project must meet the lighting requirements hereunder in order to comply with this criterion.

Classify the project under one lighting zone using the lighting zones definitions provided in the table hereunder. (Reference: Illuminating Engineering Society and International Dark Sky Association (IES/IDA) Model Lighting Ordinance (MLO) User Guide).

Lighting Zone	Zone Description	Recommended Use Areas
LZ0	**No Ambient Lighting** Areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of the flora and the fauna and/or detracting from human enjoyment and appreciation of the natural environment. Human activity is subordinate in importance to nature. The vision of human residents and users is adapted to the darkness, and they expect to see little or no lighting. When not needed, lighting should be extinguished.	Recommended default zone for wilderness areas, parks and preserves, and undeveloped rural areas. This zone includes protected wildlife areas and corridors.
LZ1	**Low Ambient Lighting** Areas where lighting might adversely affect the flora and the fauna or disturb the character of the area. The vision of human residents and users is adapted to low-light levels. Lighting may be used for safety and convenience, but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline.	Recommended default zone for rural and low-density residential areas. This zone includes single or two-family residences, agricultural zone districts, rural residential zone districts, business parks, and open space including preserves in developed areas.
LZ2	**Moderate Ambient Lighting** Areas of human activity, where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety and convenience, but it is not necessarily uniform or continuous. After curfew, lighting may	Recommended default zone for light commercial business districts and high density or mixed-use residential districts. This zone includes neighborhood business

	be extinguished or reduced as activity levels decline.	districts, churches, schools and neighborhood recreation facilities, and light industrial zoning with modest nighttime uses or lighting requirements.
LZ3	**Moderately High Ambient Lighting** Areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience, and is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline.	Recommended default zone for large cities' business district. This zone includes business zone districts, commercial mixed-use, and heavy industrial and/or manufacturing zone districts.
LZ4	**High Ambient Lighting** Areas of human activity, where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience, and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.	Not a default zone. This zone includes high intensity business or industrial zone districts.

A) Interior Lighting

All non-emergency interior lighting must be controlled to automatically turn off outside the normal hours of operation. Manual override must be provided to allow for any out-of-hours use of interior lighting, but automatic control must be resumed afterwards.

B) Exterior Lighting

B-1) Upward Lighting (Uplight)

Uplight is caused by lighting fixtures with luminous flux emitted at an angle of 90 degrees or higher from the nadir i.e., the direction directly below a particular location. The percentage uplight is the percentage of the total initial designed fixture lumens emitted at an angle of 90 degrees or higher from the nadir.
The table hereunder shows the maximum allowed percentage uplight for each lighting zone classification.

Lighting Zone	Maximum Percentage Uplight
LZ0: No Ambient Lighting	0%
LZ1: Low Ambient Lighting	0%
LZ2: Moderate Ambient Lighting	1.5%
LZ3: Moderately High Ambient Lighting	3%
LZ4: High Ambient Lighting	6%

B-2) Backlight and Glare (Vertical Illuminance)

Backlight is light which is directed outside the desired area, and which can cause light to trespass beyond the site boundary. Glare, which is caused by excessive luminaire brightness, can cause visual discomfort.

The design of the lighting system must not exceed the vertical illuminances at the lighting boundary shown in the table hereunder.

Lighting Zone	Vertical Illuminance
LZ0: No Ambient Lighting	0.5 lux
LZ1: Low Ambient Lighting	0.5 lux
LZ2: Moderate Ambient Lighting	1 lux
LZ3: Moderately High Ambient Lighting	2 lux
LZ4: High Ambient Lighting	6 lux

Grid points for vertical illuminance calculations should not be less than 1.5 meters apart. Calculations should be performed on vertical planes running parallel to the lighting boundary. The normal to each plane should be oriented toward the property and perpendicular to the lighting boundary. The vertical plane should extend from grade level to 10 meters above the height of the highest luminaire.

Lighting Boundary

The following provides guidance on the selection of the lighting boundary:

- The property line is typically considered as the lighting boundary for calculations.
- If the property line is adjacent to a public area (walkway, bikeway, or parking lot) the lighting boundary may be extended 1.5 meters beyond the property line.
- If the property line is adjacent to a public street or roadway, the lighting boundary may be extended to the centerline of the street or roadway.

Exemptions

Provided it is controlled separately from the non-exempt lighting, the following exterior lighting is exempt from these requirements:

- Specialized signal, directional, and marker lighting for transportation
- Lighting integral to equipment (i.e., ATMs)
- Lighting for occasional theatrical events (stage performance, concert, film)
- Lighting for stadiums and sports events
- Government required roadway lighting
- Hospital emergency lighting
- Lighting for the national flag.

7.3.1.5 Special Requirements

None

7.3.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.3.1-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
External Lighting Design Drawings	● The Design Drawings should show the location and the type of all external lighting fixtures.
Specifications of External Lighting	● The Specifications of all the proposed external lighting fixtures should be included.
Calculation Report of Uplight and Vertical Illuminance at Lighting Boundary	● The Calculation Report should include the calculations of both uplight and vertical illuminance at the lighting boundary.
Specifications of Interior Lighting Controls	● The Specifications of all Internal Lighting Controls should show automatic control capability.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
External Lighting As-built Drawings	● The As-built Drawings should show the location and the type of all the installed external lighting fixtures.

Manufacturer Datasheets of External Lighting	● The Manufacturer Datasheets of all the installed external lighting fixtures should be provided.
Calculation Report of Uplight and Vertical Illuminance at Lighting Boundary	● The Calculation Report should include the calculations of both uplight and vertical illuminance at the lighting boundary.
Manufacturer Datasheets of Interior Lighting Controls	● The Manufacturer Datasheets of all the internal lighting controls should show automatic control capability.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
External Lighting As-built Drawings	● The As-built Drawings should show the location and the type of all installed external lighting fixtures.
Manufacturer Datasheets of External Lighting	● The Manufacturer Datasheets of all installed external lighting fixtures should be provided.
Calculation Report for Uplight and Vertical Illuminance at Lighting Boundary	● The Calculation Report should include the calculations of both uplight and vertical illuminance at the lighting boundary.
Manufacturer Datasheets of Interior Lighting Controls	● The Manufacturer Datasheets of all internal lighting controls should show automatic control capability.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.3.1.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor (WF)**	
Interior Lighting - Automatically Switched-off Outside Working Hours	WF_1	1
Exterior Lighting - Maximum Percentage Uplight	WF_2	1*
Exterior Lighting - Vertical Illuminance at Site Boundary	WF_3	1*
*** Weight Factor will be set to 0 if project does not include exterior lighting**		

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * Weighted\ Average\ Score$$

The weighted average score for compliance with the requirements is calculated using the following formula:

$$Weighted\ Average\ Score = \frac{\sum \quad Weight\ Factors\ of\ (WF)\ compliant\ requirements}{\sum \quad Weight\ Factors\ (WF)\ of\ all\ requirements}$$

A project earns a score of 100% for this criterion by meeting all the requirements.

7.3.2 Si-3.2: Storm Water Management

7.3.2.1 Criterion Reference and Title

Si-3.2: Storm Water Management

7.3.2.2 Criterion Type

Optional

7.3.2.3 Intent

To reduce runoff volume, to improve water quality, to minimize the risk of flooding, and to protect the storm water drainage system from receiving pollutants present in water bodies.

7.3.2.4 General Requirements

Develop a storm water management plan which focuses mainly on the following:

- Quantity Control
- Quality Control.

The storm water management plan should ensure that neighboring developments will not be adversely affected by the implemented solutions, especially if the water will be discharged into adjoining water bodies.

Quantity Control

The storm water management plan must include solutions which replicate the natural hydrology and water balance of the site and, thereby, reduce the storm water runoff. Runoff occurs when excess storm water overflows from impervious surfaces, such as the ground or the building roof. Sustainable Urban Drainage Systems (SUDS) must be used to manage surface water run-off to prevent flooding and pollution. Potential techniques include

- Ground infiltration

  Ground infiltration by utilizing pervious surfaces, such as porous or pervious paving, soakaways, and non-structural solutions, such as ponds, vegetated swales, and wetlands.
- Structural methods

  Structural methods to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses. This includes collecting rain water in dedicated storage tanks to either reuse the water On-site i.e., for irrigation and flushing, or to discharge it at a later stage in order to minimize the risk of flooding.
- Other green infrastructure measures

Measures should be implemented to reduce the volume of storm water runoff from at least 75% of the project site area; these measures should be able to achieve the following:

- Rainwater collection and storage

- Ground infiltration.

Quality Control

The storm water management plan must include solutions for treatment of at least 75% of storm water On-site. The treatment system should meet the following minimum quality control requirements:

- Remove at least 95% of litter (pollutants>1mm) using physical filtration.
- Install oil separators in storm water drainage systems for areas with high risk of petrol or oil spill contamination, such as car parks.
- Provide containment for chemical liquid or gas storage areas, such as secondary containment sumps, discharge fitted with shut-off valves to prevent the escape of chemicals into natural watercourses.
- All infiltrated water through SUDS is considered 100% treated.

7.3.2.5 Special Requirements

None

7.3.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 7.3.2-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Storm Water Management Plan	The Storm Water Management Plan should describe both the quantity and the quality control strategies.
Design Drawings	The Design Drawings should show the site areas used for controlling the storm water runoffs.
Specifications	The Specifications of the On-site storm water treatment equipment should be defined.
New Building in Construction Phase	
Criterion Narrative	The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Storm Water Management Plan	The Storm Water Management Plan should describe both the quantity and the quality control strategies.

As-built Drawings	- The As-built Drawings should show the site areas used for controlling the storm water runoffs.
Manufacturer Datasheets	- The Manufacturer Datasheets of the On-site storm water treatment equipment should be provided.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Storm Water Management Plan	- The Storm Water Management Plan should describe both the quantity and the quality control strategies.
As-built Drawings	- The As-built Drawings should show the site areas used for controlling the storm water runoffs.
Manufacturer Datasheets	- The Manufacturer Datasheets of the On-site storm water treatment equipment should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.3.2.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor (WF)**	
Storm Water Runoff Reduction	WF_1	1
Storm Water Treatment On-site	WF_2	1

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{WF_1 * F_1 + WF_2 * F_2}{WF_1 + WF_2}$$

Where:

- F_1 is calculated using the following formula:
  If the percentage of the Storm Water Runoff Reduction ≥ 75%,
  $$F_1 = \frac{\%\ Runoff\ Reduction}{100}$$
  If the percentage of the Storm Water Runoff Reduction < 75%, $F_1 = 0$

- F_2 is calculated using the following formula:
  If the percentage of the Storm Water Treatment ≥ 75%, $F_2 = \frac{\%\,Storm\ Water\ Treatment}{100}$
  If the percentage of the Storm Water Treatment < 75%, $F_2 = 0$

A project earns a score of 100% if it reduces storm water runoff by 100%, and storm water treatment On-site by 100%.

7.3.3 Si-3.3: Waste Water Treatment

7.3.3.1 Criterion Reference and Title:

Si-3.3: Waste Water Treatment

7.3.3.2 Criterion Type:

Optional

7.3.3.3 Intent

To ensure that a sustainable waste water treatment strategy is in place in order to minimize the risk of polluting water bodies.

7.3.3.4 General Requirements

Waste water is defined as contaminated water discharged from building water systems. It includes:

- Blackwater: water discharged from toilets, urinals, kitchen sinks and dishwashers
- Greywater: water discharged from bathtubs, showers, lavatories, clothes-washers, and laundry tubs
  Waste water treatment is a process, through which contaminants, micro-organisms and other types of pollutants are removed by applying specialized procedures. To remove contaminants, and to produce environmentally-safe treated waste water, methods may vary from physical to chemical, and/or to biological. The treated waste water can be used for specific applications, and can be safely discharged without causing any environmental risk.

The building must be connected to the existing sewage network if it is in an area with an Off-site/centralized sewage treatment plant. However, if Off-site treatment is not provided, a dedicated sewage treatment plant should be installed as part of the project to serve that purpose. The design of the sewage treatment plant should take into consideration the following:

- The building’s expected daily discharge volume of blackwater and greywater
- The type of treatment required to meet the minimum acceptable effluent quality.

Buildings featuring food preparation areas, such as commercial kitchens in restaurants and hotels should be fitted with a grease trap. When mixed with oil and grease, waste water leads to sewer blockage, and permeates pungent odors. Grease traps, which intercept food solids and grease waste, should be cleared periodically to ensure a fully operational system.

7.3.3.5 Special Requirements

None

7.3.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.3.3-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings (Only for Project with On-site Treatment Plant)	● The Design Drawings should show the location of both the On-site waste water treatment plant and the grease traps.
Specifications (Only for Projects with On-site Treatment Plant)	● The Specifications of all the components of the waste water treatment plant, and of the grease traps should be defined and provided.
Site Plan Showing Sewer Network	● For projects with an Off-site sewage treatment plant, the site plan should show the connection of the building to the public sewer network .
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	● The As-built Drawings should show the location of both the On-site waste water treatment plant and the grease traps.
Manufacturer Datasheets	● The Manufacturer Datasheets of all the components of both the waste water treatment plant and the grease traps should be provided.
As-built Site Plan Showing Sewer Network	● For projects with an Off-site sewage treatment plant, the As-built Site Plan should show the connection of the building to the public sewer network.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

As-built Drawings	- The As-built Drawings should show the location of both the On-site waste water treatment plant and the grease traps.
Manufacturer Datasheets	- The Manufacturer Datasheets of all the components of both the waste water treatment plant and the grease traps should be provided.
As-built Site Plan Showing Sewer Network	- For projects with an Off-site sewage treatment plant, the As-built Site Plan should show the connection of the building to the public sewer network.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.3.3.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor**	
On-site / Off-site Waste Water Treatment Provided	WF_1	3
Grease Traps Provided for Commercial Kitchen(s)	WF_2	1*
*** Weight Factor will be set to 0 if project does not include commercial kitchen(s)**		

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * \frac{WF_1 * F_1 + WF_2 * F_2}{WF_1 + WF_2}$$

Where:

- F_1 is calculated using the following formula:
  If the project includes On-site or Off-site Waste Water Treatment, $F_1 = 1$
  If the project does not include On-site or Off-site Waste Water Treatment, $F_1 = 0$
- F_2 is calculated using the following formula:
  If the project does not include commercial kitchen(s), $F_2 = 1$

If the project includes commercial kitchen(s) and Grease Traps are provided,

$$F_2 = 1$$

If the project includes commercial kitchen(s) and Grease Traps are not provided,

$$F_2 = 0$$

If the project does not include On-site or Off-site Waste Water Treatment, the score for this criterion will be 0%. A project earns a score of 100% for this criterion by meeting all the requirements.

7.3.4 Si-3.4: Air Pollution Reduction

7.3.4.1 Criterion Reference and Title

Si-3.4: Air Pollution Reduction

7.3.4.2 Criterion Type

Optional

7.3.4.3 Intent

To reduce air pollution caused by On-site fossil-fuel-powered equipment used mainly for On-site electrical power generators, heating, and hot water generation.

7.3.4.4 General Requirements

Major emissions from combustion boilers include:

- Nitrogen Oxides (NOx)
- Sulfur Dioxide (SO_2)
- Particulate Matter (PM)
- Carbon Monoxide (CO).

The amount of each pollutant discharged into the atmosphere is influenced by factors, such as the type of fuel which is consumed, and the method by which it is fired; the design features of the boiler, and the way the boiler is operated, and the completeness of the combustion. Achieving the required emissions reductions involves the use of pre-combustion, combustion, or post-combustion emission control techniques, or a combination of various techniques.

During the combustion process, NOx is one of the primary pollutants emitted into the atmosphere. NOx refers to the cumulative emissions of nitric oxide (NO), nitrogen dioxide (NO_2), and trace quantities of other species. NOx reacts with heat and sunlight to produce ozone, which can cause serious respiratory problems. It also reacts with water to produce acid rain, which has a detrimental effect on ecosystems. An effective way to minimize NOx emissions is to use a low-NOx burner (LNB). These burners employ various strategies for mixing the fuel with combustion air to reduce the formation of NOx.

Combustion of sulfur-bearing fuels results in the creation of SO_2. When SO_2 oxidizes in the atmosphere, it converts into sulfuric acid, which is the main contributor to acid rain. Wet or dry scrubbers are effective post-combustion techniques for reducing SO_2 emissions to an acceptable level. SO_2 emission levels depend mainly on the selected fuel characteristics.

Combustion of any fuel which contains noncombustible material results in the formation of ash. The ash as well as any unburned carbon particles are referred to collectively as PM or fly ash. Fine PM includes dust, smoke, and soot, which can be emitted during the combustion of certain fuels, such as coal and wood. Before flue gas is discharged into the atmosphere, it is often necessary to remove as much as possible of the PM. Three techniques, which are currently being used for this purpose, either alone or in combination, include mechanical collectors (cyclone separator), wet scrubber, electrostatic precipitators (ESPs), and fabric filters.

Carbon monoxide (CO) is a colorless, odorless gas formed when carbon in fuels is not completely burned. Controlling the combustion process is very important to carry out an efficient boiler operation. Incomplete fuel combustion represents wasted energy and results in increased CO and PM emissions.

All On-site generators should be fitted with flue-gas treatment i.e., cyclone separator, diesel particulate filter and soot filter, to reduce PM emissions. In addition, NOx emission levels from combustion boilers should be less than the values in the table hereunder based on the fuel type:

Fuel Type	**NOx Emission Level**
Gas	120 mg/kWh (EN676 Class 2)
Light Oil	185 mg/kWh (EN267 Class 2)

Where there are multiple sources of heat generation, an average NOx emission rate can be calculated using the following equation:

$$NOx\ (average) = \frac{\sum \quad NO_x * Q_{burner}}{Q_T}$$

Where:

- NOx(average) = Average NOx emission rate (mg/kWh)
- NOx= NOx emission rate from burner (mg/kWh) – from burner datasheet
- Q_{burner}: Rated heating output of an individual burner(kW)
- Q_T: Total rated heating output of all burners (kW)

Heating energy sourced from renewable resources such as solar heating, PVs, wind, etc. or from heat recovery systems can be considered as having zero NOx emissions.

7.3.4.5 Special Requirements

None

7.3.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 7.3.4-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	● The Design Drawings should show all the combustion equipment: boilers and generators.
Specifications	● The Specifications of all the fuel burners should show NOx emission level limit. ● The Specifications of all the flue-gas treatment equipment should be provided.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	● The As-built Drawings should show all the combustion equipment: boilers and generators.
Manufacturer Datasheets	● The Manufacturer Datasheets of (1) all fuel burners showing NOx emission level limits, and (2) all flue-gas treatment equipment should be provided.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	● The As-built Drawings should show all combustion equipment: boilers and generators.
Manufacturer Datasheets	● The Manufacturer Datasheets of (1) all fuel burners showing NOx emission level limits, and (2) all flue-gas treatment equipment should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for certification reviewers to consider.

7.3.4.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor (WF)**	
Generator Flue-Gas Treatment	WF_1	1*
Low-NOx Burners	WF_2	1**
*** Weight Factor will be set to 0 if project does not include On-site generators** **** Weight Factor will be set to 0 if project does not include gas/oil burners**		

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Grade = 100 * F_1 * \frac{WF_1 * F_1 + WF_2 * F_2}{WF_1 + WF_2}$$

Where:

- F_1 is calculated using the following formula:
  If the project does not include On-site generators, $F_1 = 1$
  If the project includes On-site generators and Flue-Gas Treatment installed on all generators, $F_1 = 1$
  If the project includes On-site generators and Flue-Gas Treatment is not installed on all generators, $F_1 = 0$
- F_2 is calculated using the following formula:
  If all Gas/Oil Boilers are fitted with Low-NOx Burners, $F_2 = 1$
  If Gas/Oil Boilers are not fitted with Low-NOx Burners, $F_2 = 0$

If the project includes On-site generators but the Flue-Gas Treatment is not installed on all generators, the score for this criterion will be 0%. A project earns a score of 100% for this criterion by meeting all the aforementioned requirements.

7.3.5 Si-3.5: Refrigerant Management

7.3.5.1 Criterion Reference and Title:

Si-3.5: Refrigerant Management

7.3.5.2 Criterion Type:

Optional

7.3.5.3 Intent

To reduce ozone depletion and level of greenhouse gas emissions from refrigerants and fire suppression systems to minimize the impact on the environment.

7.3.5.4 General Requirements

The Ozone Depletion is a major environmental problem. In fact, because it increases the amount of ultraviolet (UV) radiation, which reaches the earth's surface, it increases the rate of skin cancer, eye cataracts, and genetic and immune system damage. The Ozone Depletion Potential (ODP) of a chemical compound is the relative amount of degradation it can cause to the ozone layer with trichlorofluoromethane (R-11 or CFC-11) being fixed at an ODP of 1.0. In order to minimize the ozone depletion impact, all refrigerants, gas fire suppression systems and maintenance gases installed and used within the project should have an ODP of zero.

Global warming occurs when carbon dioxide (CO_2), other air pollutants and greenhouse gases amass in the atmosphere and absorb sunlight, and solar radiation is reflected off the earth’s surface. Normally, this radiation would escape into space, except that these gases, which can last for years to even centuries in the atmosphere, trap the heat and cause the planet to get warmer. This is known as the greenhouse effect.

Global Warming Potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere, as a multiple of the heat which would be absorbed by the same mass of carbon dioxide (CO_2). Specifically, GWP measures how much energy the emission of 1 ton of a gas will absorb over a given period, relative to the emissions of 1 ton of carbon dioxide (CO_2). The time period usually used for GWPs is a hundred years. In order to minimize the global warming impact, the refrigerants used in heating, ventilating, air-conditioning, and refrigeration (HVAC&R) equipment should have a low Global Warming Potential.

All refrigerants and fire suppression gases must have a zero ODP. In addition, the weighted average direct effect life cycle CO_2 equivalent emissions (DELC CO_2e) of all HVAC&R refrigerants should be less than 1,000 kg CO_2e/kW cooling or heating capacity.

Direct Effect Life Cycle (DELC) carbon dioxide equivalent is a measure of the effect on global warming arising from emissions of refrigerant from the equipment to the atmosphere over its lifetime (kg CO_2 e/kW).

The DELC CO_2e for each system can be calculated using the following equation:

$$DELC\ CO_2e = \frac{GWP_r * (L_r * Life + M_r) * R_c}{CC}$$

Where:

- DELC CO_2e: Refrigerant direct effect life cycle CO_2 equivalent emissions (kg CO_2e/kW)
- GWPr: global warming potential of refrigerant (kg CO_2/kg)
- Lr: Refrigerant leakage rate (5.0% per year)
- Mr: End-of-life refrigerant loss (10%)
- Rc: Refrigerant charge (kg)
- Life: Equipment life
- CC: Cooling capacity or Heating capacity (kW).

The table hereunder shows the default equipment life for common HVAC equipment. Alternative values can be used in the calculations if manufacturers' documentation for equipment life is available.

Equipment	Default Equipment Life
Window air-conditioner/heat pump	10 years
Split, VRV, packaged air-conditioner/heat pump	15 years
Air-cooled reciprocating, scroll, screw chiller	20 years
Absorption chiller	23 years
Water-cooled centrifugal chiller	25 years
Commercial refrigeration equipment	15 years

For projects with multiple units, the weighted average Direct Effect Life Cycle CO_2 equivalent emissions (DELC CO_2e) can be calculated using the following equation:

$$DELC\ CO_2e_T = \frac{\sum \quad DELC\ CO_2e_r * Q_{unit}}{Q_T}$$

Where:

- DELC CO_2e_T = Weighted average direct effect life cycle CO_2 equivalent emissions (kg CO_2e/kW)

- DELC CO_2e_r: Direct effect life cycle CO_2 equivalent emissions (kg CO_2e/kW) for each unit
- Q_{unit}: Rated cooling or heating capacity of an individual unit (kW)
- Q_T: Total rated cooling or heating capacity of all HVAC&R (kW).

Small HVAC&R units and other equipment, such as standard refrigerators and small water coolers, which contain less than 200 grams of refrigerant, can be excluded from the calculations.

The table hereunder shows the Ozone Depletion Potential (ODP) and Global Warming Potential (GWP) of common refrigerants:

Refrigerant	**Ozone Depletion Potential (ODP)**	**Global Warming Potential (GWP)**
Chlorofluorocarbons (CFC)		
CFC-11	1.0	4,680
CFC-12	1.0	10,720
Hydrochlorofluorocarbons (HCFC)		
HCFC-22	0.04	1,780
HCFC-123	0.02	76
Hydrofluorocarbons (HFC)		
HFC-23	0	12,240
HFC-134a	0	1,320
HFC-404A	0	3,900
HFC-407C	0	1,700
HFC-410A	0	1,890
HFC-507A	0	3,900
Natural Refrigerants		
Carbon Dioxide (CO_2)	0	1.0
Ammonia (NH_3)	0	0
Propane	0	3

7.3.5.5 Special Requirements

None

7.3.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.3.5-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	● The Design Drawings should show all HVAC&R and fire suppression systems.
Schedule Of HVAC&R Equipment	● The Schedule of HVAC&R equipment should show the cooling capacities of each equipment.
Specifications	● The Specifications of all HVAC&R and fire suppression equipment should show zero ODP. ● The Specifications for all HVAC&R equipment should show types of refrigerants in use.
Calculations for Refrigerant Charge	● The Calculations of the estimated refrigerant charge in each HVAC&R system should be performed.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	● The As-built Drawings should show all HVAC&R and fire suppression systems.
Manufacturer Datasheets	● The Manufacturer Datasheets should be provided for (1) all HVAC&R equipment showing the refrigerant type, the refrigerant charge, and the rated cooling capacity, and (2) installed fire suppression equipment showing the gas type.
Report of Actual Refrigerant Charge	● The Report for Actual Refrigerant Charge should include a schedule of the actual refrigerant charge in each HVAC&R system.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	● The As-built Drawings should show all HVAC&R and fire suppression systems.
Manufacturer Datasheets	● The Manufacturer Datasheets should be provided for ● (1) all HVAC&R equipment showing the refrigerant type, the refrigerant charge, and the rated cooling capacity, and (2) installed fire suppression equipment showing the gas type.

Report of Actual Refrigerant Charge	● The Report of Actual Refrigerant Charge should include a schedule for the actual refrigerant charge in each HVAC&R system.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.3.5.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor (WF)**	
All Refrigerants and Fire Suppression Gases have Zero ODP	WF_1	1
Weighted Average DELC CO2e (kg CO2/kW)	WF_2	1

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * \frac{WF_1 * F_1 + WF_2 * F_2}{WF_1 + WF_2}$$

Where:

- F_1 is calculated using the following formula:
  If ODP of any Refrigerants or Fire Suppression Gases > 0, $F_1 = 0$
  If ODP of all Refrigerants or Fire Suppression Gases = 0, $F_1 = 1$
- F_2 is calculated using the following formula:
  If DELC $CO_2e_T \leq 1{,}000$, $F_2 = 1 - \frac{DELC\ CO_2e_T}{1000}$
  If DELC $CO_2e_T > 1{,}000$, $F_2 = 0$

If the project includes any refrigerant or fire suppression gas with ODP > 0, the score for this criterion will be 0%. A project earns a score of 100% if all refrigerants and fire suppression gases have zero ODP, and the weighted average Direct Effect Life Cycle CO_2 equivalent emissions DELC CO_2e_T is equal to zero.

7.3.6 Si-3.6: Site Noise Reduction

7.3.6.1 Criterion Reference and Title

Si-3.6: Site Noise Reduction

7.3.6.2 Criterion Type

Optional

7.3.6.3 Intent

To minimize the likelihood of noise arising from project systems and equipment, which may affect nearby noise-sensitive buildings.

7.3.6.4 General Requirements

Research indicates that the natural environment plays a very important role in human health and well-being. Noise pollution, also known as environmental noise or sound pollution, is the propagation of noise, whose ranging impacts on the activity of human or animal life is harmful to a noticeable degree. The World Health Organization (WHO) defines noise above 65 decibels (dB) as noise pollution.

There are many sources of noise pollution. Here are some of the main ones:

- Transport systems (cars, buses, trucks, airplanes, …)
- Building equipment (generators, air conditioning equipment)
- Construction sites (heavy equipment operation, power tools)
- Leisure areas/events (night life bars, restaurants, parties)
- Animals.

The project team must assess the site surroundings to check if there are existing or planned noise-sensitive areas or buildings within an 800 m radius of the assessed site. Noise-sensitive areas are defined as landscapes or buildings, whose occupants are likely to be sensitive to noises generated by the equipment or activities of the assessed building. Examples of noise-sensitive areas include

- Residential areas
- Hospitals, healthcare centers, care homes
- Schools, universities, and other educational facilities
- Libraries
- Places of worship
- Wildlife areas, parks, and gardens
- Any other development which can be classified as noise-sensitive.

If there are no noise-sensitive areas or buildings identified within an 800 m radius of the assessed site, the project will directly comply with this criterion. However, if there are noise-sensitive areas or buildings within an 800 m radius of the site, a noise impact assessment must be carried out by a suitably qualified acoustic consultant, who holds a recognized acoustic qualification. The following noise levels should be measured at the location of the identified sensitive areas or calculated in accordance with the ISO 1996 series:

- The existing background noise levels at the nearest or the most exposed noise-sensitive area
- The resulting noise levels which are produced by the project site at the same noise-sensitive area

The difference between the resulting noise level coming from the project site and the background noise level at the nearest or most exposed noise-sensitive area should not be greater than +5 dB during the day (07:00 a.m. - 11:00 p.m.) and +3 dB at night (11:00 p.m. - 07:00 a.m.).

When the noise from the project site exceeds the noise levels described above, measures should be implemented to attenuate it at its source and bring it to a level of compliance with the aforementioned limits.

7.3.6.5 Special Requirements

None

7.3.6.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.3.6-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Map	● The Site Map should show an 800m radius and should identify any existing or planned noise-sensitive areas.
Noise Impact Assessment	● The Noise Impact Assessment should include ● The background noise level measurements at the identified noise- sensitive area

	● The calculations of the expected noise level resulting from the project site ● The recommended attenuation measures if resulting noise levels exceed the maximum allowable decibels.
Qualifications of the Acoustic Consultant	● The qualified individual should hold a degree in acoustic engineering with a minimum of 10 years of experience in noise impact assessment.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Map	● The Site Map should show an 800 m radius and should identify any existing or planned noise-sensitive areas.
Noise Impact Assessment	● The Noise Impact Assessment should include measurements of noise levels for both the background noise and the resulting noise at the identified noise-sensitive area.
Qualifications of the Acoustic Consultant	● The qualified individual should hold a degree in acoustic engineering with a minimum of 10 years of experience in noise impact assessment.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Site Map	● The Site Map should show an 800m radius and should identify any existing or planned noise-sensitive areas.
Noise Impact Assessment	● The Noise Impact Assessment should include measurements of noise levels for both the background noise and the resulting noise at the identified noise- sensitive area.
Qualifications of the Acoustic Consultant	● The qualified individual should hold a degree in acoustic engineering with a minimum of 10 years of experience in noise impact assessment.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for certification reviewers to consider.

7.3.6.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	**Weight Factor (WF)**	
Daytime Noise Level Difference (dB)	WF_1	1
Nighttime Noise Level Difference (dB)	WF_2	1

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \frac{WF_1 * F_1\ +\ WF_2 * F_2}{WF_1\ +\ WF_2} * \ 100$$

Where:

- F_1 is calculated using the following formula:
  If the Daytime Noise Level Difference (dB) ≤ 5, $F_1 = 1 - \frac{Daytime\ Noise\ Level\ Difference\ (dB)}{5}$
  If the Daytime Noise Level Difference (dB) > 5, $F_1 = 0$
- F_2 is calculated using the following formula:
  If the Nighttime Noise Level Difference (dB) ≤ 3,
  $$F_2 = 1 - \frac{Nighttime\ Noise\ Level\ Difference\ (dB)}{3}$$
- If the Nighttime Noise Level Difference (dB) > 3, $F_2 = 0$

A project earns a score of 100% if both daytime and nighttime noise level differences (dB) are equal to zero.

7.4 Family: Management and Operations

7.4.1 Si-4.1: Environmental Protection Policy

7.4.1.1 Criterion Reference and Title

Si-4.1: Environmental Protection Policy

7.4.1.2 Criterion Type

Optional

7.4.1.3 Intent

(1) To avoid, minimize, or mitigate the impact of the Facility operations on the environment, (2) to improve water quality and air quality, (3) to reduce the global warming effect due to greenhouse gas emissions, and (4) to enhance the quality of life.

7.4.1.4 General Requirements

Environmental Protection Policy

Develop an Environmental Protection Policy that demonstrates the top management commitment to environmental protection. This Policy shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owners' Association signatory or president (Residential Sector).

The Environmental Protection Policy shall

- Indicate commitment to environmental protection
- Recognize applicable laws
- Commit to pollution prevention
- Commit to environmental risk assessment of the applicant's activities
- Address spreading awareness about environmental protection among all occupants
- Have a nominated environmental protection champion.

And where applicable, this policy shall require the implementation of the aforementioned requirements throughout all the three phases of design, construction, and operation.

The Policy shall have the following sections or attachments:

Mission Statement

Develop a mission statement, which includes measurable initiatives to demonstrate a commitment to environmental protection. For example, choose to commit to emission reduction by a certain percentage, to eliminate pollution, to set plantation targets, etc.

Nominated Environmental Protection Champion

The Facility shall have a nominated environmental protection champion to implement the environmental protection policy and its initiatives.

- The environmental protection champion could be an employee of the Facility, a resident of the Facility (Residential Sector) or, otherwise, a subcontractor. He or She should report to the head of the Applicant's organization or the Owners' Association (Residential Sector).
- He or She can be either a dedicated manager or officer, or a staff member, who takes on this role in addition to other roles he or she already has in the Facility.
- The job requirements should include the following minimum tasks:
    - Enforce the Environmental Protection Policy
    - Raise awareness about emission and pollution reduction
    - Ensure the execution of the Applicant’s initiatives as indicated in the mission statement.
- The Environmental Protection Champion shall be a qualified individual or entity who is certified in sustainability or Facility management from an industry recognized certification body, or who holds a degree in engineering, and has a minimum of 3 years of experience in sustainability or Facility management.

ISO 14001 certification

The Facility shall have an environmental management system. It shall also acquire and retain a valid ISO 14001 certificate from an ISO certification office.

Compliance

The policy shall require compliance with the applicable environmental laws. The operating procedures shall list the applicable decrees.

The Applicant shall set targets which are more stringent than the requirements set out in applicable decrees; He or She could go as far as applying international requirements which are not locally regulated i.e., included in current decrees.

The Applicant shall request compliance with applicable environmental laws from the vendors including contractors and subcontractors; the Applicant will conduct business with only vendors and contractors who can demonstrate compliance with applicable environmental laws.

Measure compliance

The Applicant shall demonstrate how the Facility is monitoring the application of its environmental protection policy and initiatives, and the impact of its operations on the environment. A monitoring report shall be issued annually.

Environmental Impact Assessment

Develop an environmental impact assessment of the Facility operations to identify the potential hazards which the Facility operations may pose on the environment. Develop a plan to eliminate, reduce, or mitigate, their effect on the environment. The impact assessment must investigate the impact of the Facility operations on pollution generation, including but not limited to, odor, noise, vibration, waste, gas emissions, and light pollution.

The environmental impact assessment shall be reviewed one year from the start of operations and at least at 3 years' intervals thereafter.

In addition, the Facility shall conduct an environmental impact assessment of all new activities during the planning phase.

And the Facility shall conduct an environmental impact assessment of all renovation and construction projects during the planning phase.

Demonstrate that the aforementioned requirements are implemented:

New Building

Provide a commitment to submit, for three consecutive years, the following environmental impact assessments as per the indicated timing:

- One environmental impact assessment of the Facility operations a year from the start of operations
- A yearly environmental impact assessment of all new activities, and renovation and construction projects
- One environmental impact assessment of the Facility operations at the end of the aforementioned three-year period.

Existing Building

Provide the following environmental impact assessments for three consecutive years as per the indicated timing:

- One environmental impact assessment of the Facility operations at the date of application for certification (the assessment shall not be older than three years)
- A yearly environmental impact assessment of all new activities, and renovation and construction projects
- One environmental impact assessment of the Facility operations at the end of the aforementioned three-year period.

Three consecutive years means that this period could refer to the three post-certification years, or to the past three years, if available, or any combination of past years and future years, provided that the three years are consecutive. In case of a post-certification record submittal, a prior binding commitment is required.

This policy could be part of another policy, such as an environmental, safety, and health policy, or a social responsibility policy, etc.

7.4.1.5 Special Requirements

None

7.4.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.4.1-1 Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Outline of the Environmental Protection Policy	● Provide a simple outline showing the scope of the policy that includes one or more of the following: ○ The Mission Statement ○ The Job Description of the Environmental Protection Champion ○ The Commitment to secure ISO 14001

	○ The List of applicable laws ○ The Demonstration of how the Facility will exceed the requirements of these laws to acquire an additional score ○ The Commitment to work with compliant vendors ○ The Commitment to conduct an Environmental Impact Assessment of the Facility operations.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Environmental Protection Policy	● Provide an Environmental Protection Policy which includes one or more of the following: ○ The Mission Statement ○ The Job Description of the Environmental Protection Champion ○ The Commitment to secure ISO 14001 ○ The List of applicable Laws ○ The Demonstration of how the Facility will exceed the requirements of these laws to acquire an additional score ○ The Commitment to work with compliant vendors ○ The Commitment (1) to conduct an Environmental Impact Assessment of the Applicant's new activities, and renovation and construction projects, and (2) to implement mitigation measures, which reduce the impact on the environment.
Name and Qualifications of the Environmental Protection Champion	● Supply the name and the qualifications of the environmental protection champion.
Vendor Commitment	● Submit copies of the Vender Commitment, in which all vendors i.e., contractors, subcontractors, and suppliers, comply with the applicable environmental laws.
Vendor List	● Submit a Vendor List to demonstrate that all the vendors i.e., contractors, subcontractors, and suppliers, commit to comply with the applicable environmental laws.
Measured KPIs	● Demonstrate how the Applicant is monitoring the application of the set commitments.
Environmental Impact Assessments	● Conduct Environmental Impact Assessments of the following: (1) The Applicant's operations (2) The implemented mitigation measures, which reduce the impact on the environment.
Existing Building	

Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Environmental Protection Policy	● The Environmental Protection Policy includes one or more of the following: ○ The Mission Statement ○ The Job Description of the Environmental Protection Champion ○ The Commitment to secure ISO 14001 ○ The List of applicable Laws ○ The Demonstration of how the Facility will exceed the requirements of these laws to acquire an additional score ○ The Commitment to work with compliant vendors ○ The Commitment (1) to conduct an Environmental Impact Assessment of the Applicant’s new activities, renovation, and construction projects, and (2) to implement mitigation measures which reduce the impact on the environment.
Evaluation Reports of Targets	● Submit the Evaluation Reports of the status of the targets, which are indicated in the Mission Statement. They should include the measures taken and the achievement percentage of each target.
Name and Qualifications of The Environmental Protection Champion	● Provide the name and the qualifications of the environmental protection champion.
Iso 14001 Certificate	● Provide a valid copy of the ISO 14001 certificate.
Vendor Commitment	● Submit copies of the Vender Commitment, in which all vendors i.e., contractors, subcontractors, and suppliers, comply with the applicable environmental laws.
Vendor List	● Submit a Vendor List to demonstrate that all the vendors i.e., contractors, subcontractors, and suppliers, commit to the compliance with the applicable environmental laws.
Measured KPIs	● Demonstrate how the Applicant is monitoring the application of the set commitments.
Environmental Impact Assessments	● Conduct Environmental Impact Assessments of the following: (1) The Applicant’s operations (2) The implemented mitigation measures, which reduce the impact on the environment.
Environmental Impact Assessments of New Activities and Renovation and Construction Projects	● Conduct Environmental Impact Assessments of the following: (1) The Applicant’s new activities, and renovation and construction projects (2) The implemented mitigation measures, which reduce the impact on the environment.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.1.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement i.e., meeting performance thresholds or implementing strategies described in the Requirements sections.

Table 7.4.1-2. Factors and Weight Factors for Each Parameter

Parameter	**Parameter No (i)**	**Status**	**Factor "F_i"**	**Weight Factor "WF_i"**
Does the Facility have an Environmental Protection Policy?	1	Yes / No	1 / 0	2
Does the Facility have a Mission Statement for environmental protection with targets to be met?	2	Yes / No	1 / 0	2
Does the Facility have a nominated Environmental Protection Champion?	3	Yes / No	1 / 0	3
Does the Facility have an ISO 14001 certification?	4	Yes / No	1 / 0	5
Does the Applicant comply with applicable environmental laws?	5	Yes / No	1 / 0	1
Does the Applicant exceed the requirements of applicable laws?	6	Yes / No	1 / 0	3
Does the Applicant request compliance with applicable laws from its business partners (Vendors and Contractors)?	7	Yes / No	1 / 0	5
Does the Applicant measure the Facility's compliance with environmental applicable laws and Facility procedures? What are the KPIs?	8	Yes / No	1 / 0	3

Does the Applicant request the periodic Environmental Impact Assessment of the Facility activities?	9	Yes / No	1 / 0	5
Does the Applicant request an Environmental Impact Assessment of all new activities?	10	Yes / No	1 / 0	5
Does the Applicant request an Environmental Impact Assessment of all new renovation and construction projects?	11	Yes / No	1 / 0	5

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{11} (F_i * WF_i)}{\sum_{i=1}^{11} WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

7.4.2 Si-4.2: Environmental Protection Awareness

7.4.2.1 Criterion Reference and Title

Si-4.2: Environmental Protection Awareness

7.4.2.2 Criterion Type

Optional

7.4.2.3 Intent

To improve the occupants’ engagement and participation in successfully adopting and implementing environmental protection initiatives. To increase the occupants’ awareness about sustainability and to change human behavior through education.

7.4.2.4 General Requirements

- Carryout awareness campaigns to attain the objectives hereunder:
  1. Hold gatherings or workshops to educate all occupants about the Environmental Protection Policy.
  2. Share with the occupants the achievements pertaining to the mission statement.
  3. Circulate / Post informative e-mails, banners, or labels in the Facility.
  4. Install a system to capture and reward successes to retain the occupants’ engagement.
- Allocate a budget for awareness campaigns.
- Capture occupant feedback on how to achieve additional targets as per the mission statement.

Environmental Protection Awareness Campaigns

The campaigns shall be led and delivered by a certified green building professional with, at least, 8 years of experience in sustainability.

At least one awareness campaign is required before a new building in the construction phase is granted certification. The minimum attendees shall be the Applicant’s managers and the maintenance team.
At least one awareness campaign is required before certification for the existing building with a refresher every other year. The minimum attendees shall be the Applicant’s managers, the maintenance team, and the occupants who shall be issued an invitation to attend.

Ensure that the occupants are aware of the initiatives which the Facility is taking to comply with applicable laws. Share with the occupants, where applicable, the environmental excellence initiatives, where the Facility exceeds the legislative requirements. Target the initiatives and achievements which relate to

- Emission reduction
- Pollution reduction, such as
  - Noise pollution reduction
  - Light pollution reduction
  - Pollution from maintenance activities.
- Maintenance of plantation and addition of planted /vegetated areas
- Properly maintained grounds
- Carpooling.

The above could be shared either at functions which are dedicated to publicize these achievements, or at other gatherings.

The Facility shall plan and share informative materials in the form of emails, banners, labels, etc., to raise environmental protection awareness. Such informative material shall be circulated at least quarterly.

A system to capture and reward successes shall be implemented to retain the occupants' engagement.

Demonstrate the above for three consecutive years starting no later than the date of applying for certification. That means, the considered three years could be either pre or post certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive.

Awareness Budget. The Facility shall have an approved five-year budget for Environmental Protection Awareness Campaigns. The approved budget should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.

Occupants' Feedback

The Facility shall circulate periodic questionnaires to all occupants to seek feedback regarding environmental protection initiatives, challenges of implementation, and any additional possible opportunities.

The Facility shall encourage Occupant feedback at any time, by allocating suggestion boxes or a dedicated email address for collecting sustainability suggestions and feedback. Demonstrate that the above is being implemented:

New Building

Provide a commitment to submit necessary records for three consecutive years starting no later than the date of applying for certification.

Existing Building

Provide necessary records for three consecutive years, which could be for the three post-certification years, or for the past three years, if available, or any combination of past and future years provided they are consecutive. In case of a post-certification record submittal, a prior binding commitment is required. This measures the involvement of the occupants in environmental protection, and reflects the effect of the efforts of the Facility to foster awareness among its occupants.

7.4.2.5 Special Requirements

None

7.4.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.4.2-1. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Environmental Protection Awareness Campaigns	● Submit Agendas of planned gatherings, meetings, or workshops related to Environmental Protection Awareness.
List of Initiatives	Provide the List of The Initiatives which shall include ● A list of the applicable environmental laws, which the Facility shall comply with ● A list of environmental protection initiatives
List of Informative Materials	● Provide the List of Informative Materials, which will be used to raise environmental protection awareness.
Outline of the Incentive System	● Provide an Outline of the Incentive System, which will be part of the Human Resources procedures and reward systems.

A Five-year Budget Plan for Awareness Campaigns	● Provide a Five-Year Plan for Environmental Protection Awareness Campaigns, and a list of the planned events, and the total budget per annum.
Outline of Questionnaires for Environmental Protection	● Provide an Outline of The Questionnaires which solicit occupants' feedback regarding current environmental protection initiatives, challenges, and opportunities.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Environmental Protection Awareness Campaigns	● Provide (1) the agendas of gatherings, meetings, or workshops related to Environmental Protection Awareness, and (2) the name and qualifications of the qualified professional, who will lead the campaign.
Attendance sheets of the Environmental Protection Awareness Campaigns	● Provide Attendance Sheets of the Environmental Protection Awareness Campaigns, which should comprise a list of all the managers of the Facility and all the members of the maintenance team, and should indicate who attended each function and who did not and when.
The Facility Organization Chart	● Provide the Organization Chart of the Facility or of the Owners' Association.
List of Initiatives	● Provide the List of Initiatives, which the Facility shall comply with: ○ A list of the applicable environmental laws ○ A list of the environmental protection initiatives.
Informative materials	● Provide planned informative materials to raise environmental protection awareness.
Documented Incentive System	● Provide the document describing the Incentive System.
Approved Five-year Budget for Awareness Campaigns	● Provide an Approved Five-Year Budget for Environmental Protection Awareness Campaigns. ● Provide a list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.
Questionnaires for Environmental Protection	● Provide Questionnaires to solicit occupants' feedback regarding environmental protection initiatives, challenges, and opportunities.
Existing Building	

Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Environmental Protection Awareness Campaigns	● Provide (1) the agendas of gatherings, meetings, or workshops related to Environmental Protection Awareness, and (2) the name and qualifications of the qualified professional, who led the campaign.
Attendance sheets of the Environmental Protection Awareness Campaigns	● Provide the Attendance Sheets of the Environmental Protection Awareness Campaigns, which should comprise a list of all the occupants of the Facility, and should indicate who attended each function and who did not, and when.
The Facility Organization Chart	● Provide the Organization Chart of the Facility or of the Owners' Association.
List of Initiatives	● Provide the List of Initiatives, which the Facility shall comply with: ○ A list of the applicable environmental laws ○ A list of the environmental protection initiatives.
Informative materials	● Provide informative materials, which were used to raise environmental protection awareness.
Documented Incentive System	● Provide the document describing the Incentive System.
List of Recognized Occupants	● Provide the list of the occupants, who were recognized for their contribution to the Facility environmental protection initiatives for the past three years.
Approved five-year Budget for Awareness Campaigns	● Provide an approved five-year budget for Environmental Protection Awareness Campaigns. ● Provide a list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.
Expenditures on Awareness Campaigns for Three Consecutive Years	● Provide expenditures on environmental protection awareness campaigns for three consecutive years.
Questionnaires for Environmental Protection	● Provide Questionnaires to solicit occupants' feedback regarding current environmental protection initiatives, challenges, and opportunities.
Occupants' feedback	● Provide copies of Occupants' Feedback to questionnaires along with other suggestions regarding environmental protection initiatives for the past three years.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.2.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections.

Table 7.4.2-2. Required submittals

Parameter	**Parameter No (i)**	**Status**	**Factor “F_i”**	**Weight Factor “WF_i”**
Is the Environmental Policy well-communicated to all occupants through gatherings or workshops?	1	Yes / No	1 / 0	1
Are strategies for compliance with applicable laws shared with occupants?	2	Yes / No	1 / 0	2
Are environmental excellence initiatives for exceeding the legislative requirements shared with occupants?	3	Yes / No	1 / 0	3
Are informative e-mails, banners, or labels circulated / posted in the Facility?	4	Yes / No	1 / 0	1
Is a system to capture and reward successes implemented to retain the occupants’ engagement?	5	Yes / No	1 / 0	3
Is a budget for awareness campaigns allocated by the Facility?	6	Yes / No	1 / 0	4
Does the Facility solicit occupants’ feedback regarding Environmental Protection?	7	Yes / No	1 / 0	4
Average number of occupants who shared their feedback (average of the past 3 years).	8	V_8	F_8	5
Total number of occupants	9	V_9		

F_8 is calculated using the following formula:

$$F_8 = \left(\frac{V_8}{V_9}\right) * 2$$

Where

V_8 is the average number of occupants who shared feedback (average of the past 3 years)

$$V_8 = \left(\frac{\sum_{i=1}^{3} \quad Number\ Of\ Occupants\ who\ shared\ feedback_{Year\ i}}{3}\right)$$

V_9 is the total number of occupants at the Facility

F_8 Maximum value is 1

In order to determine the criterion score, the following formula is applied:

New Building

$$Criterion\ Score = \ 100 * \left[\frac{\sum_{i=1}^{7} \quad (F_i * WF_i)}{\sum_{i=1}^{7} \quad WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

Existing Building

$$Criterion\ Score = \ 100 * \left[\frac{\sum_{i=1}^{8} \quad (F_i * WF_i)}{\sum_{i=1}^{8} \quad WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements and by ensuring that the occupants’ shared feedback reached at least 50% on average over the past three years.

7.4.3 Si-4.3: Construction Environmental Management System

7.4.3.1 Criterion Reference and Title

Si-4.3: Construction Environmental Management System

7.4.3.2 Criterion Type

Optional

7.4.3.3 Intent

To avoid, minimize, or mitigate the environmental impact of the construction activities, such as polluting gas emissions, polluting rejects, noise pollution and others.

7.4.3.4 General Requirements

Monitor and limit the environmental impact of the construction activities:

- Monitor and reduce On-site power generators exhaust emissions.
- Monitor and reduce construction equipment exhaust emissions.
- Implement suitable containment for On-site diesel storage.
- Prohibit construction material, lubricant, and any construction waste from infiltrating in waterways and drains.
- Monitor and reduce noise, airborne dust, and nightlight pollution to safeguard surrounding buildings.

Measure and limit the emissions from On-site power generators to the limits described under Si-4.7 and in applicable laws. Measure and report emissions upon the installation of a generator, and then repeat it every six months thereafter.

All engine-powered construction equipment, earth-moving equipment, trucks, and vehicles, whether owned, subcontracted, or leased for construction works or transportation, shall have Euro 3 engines or better. Demonstrate through spot checks that emissions are at least within the Euro 3 emissions limits. This requirement shall not apply for equipment, which is used once during the construction phase for less than 24 hours (occasional emergency use).

All On-site fuel storage tanks shall have a containment, the volume of which is 120% of the fuel storage tanks total volume.

Prohibit any kind of construction wastes from infiltrating in storm water mains, sewer mains, or any other waterways. Develop a method statement on how the construction will reduce contaminated water. Develop method statements on how the construction will prohibit contaminated water or rainfall loaded with construction contaminants from infiltrating in any waterways. Demonstrate how the above was achieved during the construction phase.

To reduce noise pollution to safeguard surrounding buildings, consider implementing the following measures:

- Install mufflers/silencers for engine-powered equipment.
- Construct sound barriers around noisy equipment.
- Maintain equipment properly well-lubricated and free of imbalances to suppress any noise which might generate.
- Demonstrate that noise, at the worst affected property, shall neither exceed 60dBA for repetitive scheduled works, nor peak beyond 75dBA in case of unusual scheduled works. Neighbors shall be notified 48hours prior to any unusual scheduled works. Working hours during which noisy activities are carried out shall be reduced, and shall not be scheduled outside the following time frames:
  Weekdays: 7a.m - 7p.m.
  Weekends and Legal Holidays: 9a.m - 8p.m.
  Outside these working hours, the noise level from construction activities shall not exceed 45dBA at the most affected property.

Control and limit airborne dust from all construction activities. Develop method statements to control and limit the spread of airborne dust. For this end, consider the use of any the following, but not limited to: physical barriers, fog cannons, regular manual and mechanical dust sweeping, etc. Demonstrate the way these method statements are applied and their effectiveness during the construction phase.

Comply with the requirements of nightlight pollution of criterion Si-3.1 to minimize light pollution during nighttime. This measure improves night sky visibility and reduces the impact on nocturnal wildlife and surrounding properties.

Nominated Environmental Protection Officer

The construction project management team shall have a nominated Environmental Protection Officer for the project site. The project management team of each contractor, who has a direct contract with the Applicant shall have a nominated counter officer to act as the single point of contact (SPOC) for that contractor.

- The Environmental Protection Officer is either an employee of the construction project management team or the Applicant, or otherwise subcontracted directly by the Applicant. He should report to the project manager and to the head of the applicant organization.
- He can either be a dedicated manager or officer, or a staff member who takes on this role in addition to other roles in the Facility.
- The job requirements should include the minimum environmental impact reduction / mitigation tasks.
- The Environmental Protection Officer shall be a qualified individual or entity, who is certified in sustainability or Facility management from an industry recognized certification body, or who holds a degree in engineering, and has a minimum of 3 years of experience in sustainability or Facility management.

ISO 14001

The Main Contractor shall hold an ISO 14001 Certificate, which is issued by an approved ISO certification office. The ISO 14001 shall be valid or renewed to fully cover the construction phase of the project. That is, the main contractor shall maintain a valid ISO 14001 certificate throughout the whole project.

Utility Consumption

Monitor the monthly electric energy consumption and water consumption from all sources during the construction phase. Submit the monthly electric energy meters readings, the water meters readings, tanker deliveries, On-site well water meters readings, etc.

During the design phase, provide an estimated value of the total electric energy consumption and the total water consumption, which will be incurred over the timespan of construction.

Transportation

The Main Contractor shall monitor and record the total distance traveled for major construction material. The electrical and mechanical material, the plumbing material, the furniture, and the equipment won't be included in this calculation. The monitoring shall cover the distance of travel of each shipment from the factory, or the source at the country of origin of the material, to the construction site. Record for each shipment the weight, and the distance of travel. The latter should be split among the following modes of transportation: Inland trucks, waterways, rail, sea freight, and air freight.

Based on the traveled distance of each mode of transportation and shipment weight, estimate the total fuel consumption for the project.

During the design phase, provide an estimated value for the expected total fuel consumption for the transportation of major materials as described above.

7.4.3.5 Special Requirements

None

7.4.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 7.4.3-1. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Job Description of the Nominated Environmental Protection Officer	● Provide the job description for the Nominated Environmental Protection Officer and the minimum required qualifications.
ISO 14001 Certificate	● Provide the section of the tender documents mandating a valid ISO 14001 certificate from the main contractor for the timespan of the project.
Pollution Prevention	● Provide the section of the tender documents including the requirements for each of the selected initiatives for pollution prevention.
Electric Energy Consumption	● Provide the section of the tender documents requesting electric power meters and tracking.
Total Electric Energy Consumption	● Provide the calculation note estimating the total electric energy consumption during the construction phase.
Water Consumption	● Provide the section of the tender documents requesting water meters and tracking of water deliveries.
Total Water Consumption	● Provide the calculation note estimating the total water consumption during the construction phase.
Transportation	● Provide the section of the tender documents requesting tracking the shipment weight and the travel distance for each mode of transportation used.

Total Transportation Fuel Consumption	● Provide the calculation note estimating the total fuel consumption of these shipments.
New Building in Construction Phase	
Criterion narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Job Description of the Nominated Environmental Protection Officer	● Provide the job description for the Nominated Environmental Protection Officer and the minimum required qualifications.
Name and Qualifications Environmental Protection Officer	● Provide the name and the qualifications of the nominated Environmental Protection Officer.
ISO 14001 Certificate	● Provide a valid ISO 14001 Certificate for the timespan of the construction project.
Emission Measurement Reports of On-Site Generators	● Provide emission measurement reports of each On-site generator upon installation and every six months thereafter.
List of Engine- Powered Equipment	● Provide the list of all engine-powered construction equipment, earth-moving equipment, trucks, and vehicles (leased or owned).
Datasheets of Engine-Powered Equipment	● Provide the datasheets of the engine-powered equipment to demonstrate Euro 3 or better engine rating.
Emission Spot Check Reports of Engine-Powered Equipment	● Provide the emission spot check reports of engine-powered equipment including compliance with Euro3 requirements.
List of On-site Diesel Storage Tanks	● Provide the list of all On-site diesel storage tanks and their capacities.
Diesel Storage Tank Containment Drawings	● Provide the As-built Drawings of the location of each On-site diesel storage tank with the containment details and dimensions.
Method Statements to Protect Waterways and Drains	● Provide the Method Statements to protect waterways and drains from construction wastes. ● Demonstrate how this was achieved during the construction phase.
Sound Measurement Reports at Neighbors	● Provide the sound measurement reports at the worst affected property, at different times of the day, and at different phases of the construction.
Method Statements for Dust Control	● Provide the Method Statements to control and limit airborne dust from all construction activities.

Dust Control	● Provide evidence of the implementation and effectiveness of dust control Method Statements.
External Construction Site Lighting As-Built Drawings	● Provide the As-built Drawings showing the location and type of all installed external lighting fixtures.
Manufacturer Datasheets of External Lighting	● Provide the Manufacturer Datasheets of the construction site external lighting.
Calculation Report for Uplight and Vertical Illuminance at Lighting Boundary	● Provide the report which includes the calculations for both uplight and vertical illuminance at lighting boundary.
Electric Energy Consumption	● Provide the monthly electric energy meter readings.
Water Consumption	● Provide the monthly water meter readings and water delivery receipts.
Transportation	● Provide the list of all shipments of major construction material, the weight of each one, and the traveled distance covered by each mode of transportation used during shipment.
Total Transportation Fuel Consumption	● Provide the estimate of the total fuel consumption based on the actual shipments.
Existing Building	
Not Applicable	

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.3.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 7.4.3-2. Factors and Weight factors for each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Does the construction project management team have a nominated Environmental Protection Officer?	1	Yes / No	1 / 0	3
Does the main contractor hold an ISO 14001 Certificate?	2	Yes / No	1 / 0	5
Are the exhaust emissions of On-site power generators monitored and reduced?	3	Yes / No	1 / 0	3
Are the exhaust emissions of construction equipment monitored and reduced?	4	Yes / No	1 / 0	5
Is On-site diesel storage suitably contained?	5	Yes / No	1 / 0	1
Are construction materials, lubricants, and construction wastes prohibited from being filtered in waterways and drains?	6	Yes / No	1 / 0	5
Are noise, airborne dust, and nightlight pollution monitored and reduced to safeguard surrounding buildings?	7	Yes / No	1 / 0	5
Indicate the total electric energy consumption of the project (kWh).	8	Provided / Not Provided	1 / 0	2
Indicate the total water consumption of the project (Lit).	9	Provided / Not Provided	1 / 0	2
Does the main contractor monitor and record the total distance traveled by the major construction materials?	10	Yes / No	1 / 0	3
The total fuel consumption for the project (Lit).	11	Provided / Not Provided	1 / 0	3

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{11} \quad (F_i * WF_i)}{\sum_{i=1}^{11} \quad WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

7.4.4 Si-4.4: Carpooling

7.4.4.1 Criterion Reference and Title

Si-4.4: Carpooling

7.4.4.2 Criterion Type

Optional

7.4.4.3 Intent

(1) To reduce the parking capacity in order to limit the site disturbances and the related storm water run-offs. (2) To reduce the heat island effect. (3) To maximize the open spaces. (4) To reduce the carbon emissions associated with the use of individual cars.

7.4.4.4 General Requirements

The criterion requirements include the following:

1- Assist Rideshare Matching consists of assisting the employees to locate nearby carpoolers with similar schedules. The Applicant shall demonstrate the participation of the building occupants in a carpooling program organized by the Applicant himself/herself or by any other independent entity. It could be by creating an internal web page for carpool-matching, or by giving instructions to supervisors to apply flexible work schedules to allow for carpool-matching, etc.

2- Provide access to an emergency ride home by establishing a transportation service for the use of carpoolers when needed. The Applicant shall ensure the availability of an alternative ride to the carpoolers to attend to any emergency. This alternative can be free of charge or at a reduced cost compared to market prices. Such measures will encourage carpooling in case a member needs to leave work early due to an emergency at home or needs to stay late due to an emergency at work. Hence his/her transportation is secured.

3- Organize awareness campaigns to communicate and promote carpooling strategies. In order to encourage the building occupants to participate in a carpooling program, the Applicant shall organize carpooling awareness campaigns at least twice a year. The campaign may well be an organized in-person event or an online presentation/meeting, during which all building occupants meet and try to find potential carpool partners.

4- Offer benefits for carpoolers by

- Reducing their parking rates or fully exempting them from any payments
- Reserving for them at least 5% of parking capacity close to the preferred parking spots, which are the closest to the main entrance of the project, or located in shaded areas, and which are usually reserved for the handicapped.
- Implementing a reward program using raffles, for example. The Applicant shall set up a reward program for the carpoolers who were the most committed to the carpooling services throughout the year. The reward may be any incentive to encourage carpooling. To prevent any fraudulent activity from taking place, maintain a list of the carpoolers' names and vehicles, and conduct spot checks of the departure and arrival times of each group of carpoolers as registered by punch in/out machines.

7.4.4.5 Special Requirements

None

7.4.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.4.4-1. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Parking Layout Plan	● The Layout Plan should show the 5% parking capacity assigned for carpooling and located close to the preferred parking spots reserved for the handicapped.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Demonstration of Participation in Carpooling Program	● The document should demonstrate the participation of the building occupants in a carpooling program organized by the Applicant or by any other independent entity.
Alternative Emergency Ride Home	● The document should show the alternative ride home, which carpoolers are provided in case of an emergency.
Awareness Campaign	● The document should include

	● The schedule of the awareness campaigns, which shall be conducted at least twice a year ● The narrative which clarifies how these campaigns shall be organized.
Designated Parking Spaces for Carpooling	● The Layout Plan should show that the 5% parking capacity assigned for carpooling is located close to the preferred parking spots, which are usually reserved for the handicapped.
Commercial Benefits for Carpoolers	● The document should highlight the commercial benefits granted to committed carpoolers, such as reduced rates on parking or free parking.
Rewards	● The document should identify the reward offered to committed carpoolers.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Demonstration of Participation in Carpooling Program	● The document should demonstrate the participation of the building occupants in a carpooling program organized by the Applicant or by any other independent entity.
Alternative Emergency Ride Home	● The document should show the alternative ride home, which carpoolers are provided in case of an emergency.
Awareness Campaign	● The document should include ● The schedule of the awareness campaigns, which were conducted during the year of application ● The narrative which clarifies how these campaigns had been organized ● The schedule of the upcoming awareness campaigns.
Designated Parking Spaces for Carpooling	● The Layout Plan should show that the 5% parking capacity assigned for carpooling is located close to the preferred parking spots, which are usually reserved for the handicapped.
Commercial Benefits for Carpoolers	● The document should highlight the commercial benefits granted to committed carpoolers, such as reduced rates on parking or free parking.
Rewards	● The document should identify the reward offered to committed carpoolers.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting

documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.4.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

The proposed parameters in this module are optional, and each one of them will reward the Applicant a certain percentage of accomplishment as summarized hereunder.

Table 7.4.4-2. Factors and Weight factors for each Parameter

Parameter	**Parameter No (i)**	**Status**	**Factor "F_i"**	**Weight Factor "WF_i"**
Does the Applicant facilitate rideshare matching?	1	Yes / No	1 / 0	4
Does the Applicant assist carpoolers by providing them with an emergency ride home when the need arises?	2	Yes / No	1 / 0	5
Does the Applicant communicate carpooling strategies effectively through awareness campaigns?	3	Yes / No	1 / 0	3
Does the Applicant offer benefits for committed carpoolers?				
● Reduced parking rates or free parking	4	Yes / No	1 / 0	4
● Preferred parking locations	5	Yes / No	1 / 0	2
● Reward program: raffles	6	Yes / No	1 / 0	2

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{6} \quad (F_i * WF_i)}{\sum_{i=1}^{6} \quad WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

7.4.5 Si-4.5: Plantation Care/Soft Landscaping Maintenance Program

7.4.5.1 Criterion Reference and Title

Si-4.5: Plantation Care / Soft Landscaping Maintenance Program

7.4.5.2 Criterion Type

Optional

7.4.5.3 Intent

To maintain the plantation and soft landscaping at the Facility, and preserve their condition. To enhance the quality of life through a healthy outdoor environment.

7.4.5.4 General Requirements

Develop Maintenance Manuals and a Maintenance Regime for the following plantations if installed at the Facility:

Table 7.4.5-1. Grounds and Infrastructure Systems

Area Wide General Landscape	**Hedgerows and Vines**
Picking litter	Carrying out an assessment of dead/missing plants
Removing fallen leaves	Replacing failed plantation
Trees	Applying weed control to all plants
Inspecting trees for damage and disease	Watering
Carrying out an assessment of dead or missing trees	Re-firming
Replacing failed trees	Ensuring pest and disease control
Applying weed control around each tree	Pruning / Shaping
Watering	Fertilizing
Re-firming	**Shrubs and Groundcovers**
Ensuring pest and disease control	Carrying out an assessment of dead/missing plants
Pruning	Replacing failed plantation
Fertilizing	Applying weed control to all plants
Maintaining the mulch	Watering
	Aerating the soil

	Grass and Amenity Grass
	Mowing
	Fertilizing
	Seeding

Maintenance Regime

The Operation and Maintenance (O&M) manuals shall include all applicable plantations and shall define the maintenance regime, i.e., frequencies and details of each job plan.

The job plans and the maintenance tasks shall be executed at a frequency which is equal to or lower than what is listed hereunder as minimum acceptable frequencies.

Table 7.4.5-2. Minimum Acceptable Maintenance Frequencies

System	Minimum Acceptable PM Frequencies
Area Wide General Landscape	
Picking litter	Weekly
Removing fallen leaves	Weekly
Trees	
Inspecting trees for damage and disease	Annually
Assessing dead/missing trees	Annually
Replacing failed trees	Annually
Applying weed control around each tree	Monthly
Watering	Twice monthly
Re-firming	Monthly
Ensuring pest and disease control	When required
Pruning	As Instructed
Fertilizing	Annually
Maintaining the Mulch	Twice a year
Hedgerows and Vines	
Assessing the dead/missing plants	Annually
Replacing failed plantation	Annually
Applying weed control to all plants	Monthly

Watering	Twice Monthly
Re-firming	Monthly
Ensuring pest and disease control	Annually
Pruning / Shaping	When required
Fertilizing	Annually
Shrubs and Groundcovers	
Assessing dead/missing plants	Annually
Replacing failed plantation	Annually
Applying weed control to all plants	Monthly
Watering	Twice monthly
Aerating the soil	Twice a Year
Ensuring pest and disease control	When required
Pruning / Shaping	Monthly
Fertilizing	Annually
Grass and Amenity Grass	
Mowing	Weekly
Fertilizing	Twice a Year
Seeding	When required

Demonstrate that maintenance is being applied as per the maintenance regime. The maintenance regime must be executed, and the Facility should provide documented evidence for that. As a minimum, job plans and check lists are filled, dated, and signed by the maintenance supervisor. The jobs and dates must reflect the tasks and frequencies as dictated by the maintenance regime.

New Building

Provide a commitment to submit necessary records for three consecutive years, starting no later than the date of applying for certification.

Existing Building

Provide necessary records for three consecutive years, which could refer to the three post-certification years, or to the past three years, if available, or any combination of past and future years provided that the three years are consecutive. In case of a post-certification record submittal, a prior binding commitment is required.

For an existing building, conduct a condition assessment of the available plantations.

Who is qualified for the job?

- A qualified individual or entity, who is certified in agriculture
- A Facility management from an industry recognized certification body
- A degree holder in agriculture with a minimum of 3 years of experience in agriculture or Facility management.

7.4.5.5 Special Requirements

None

7.4.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.4.5-2. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Maintenance Requirements	● The tender documents should include a section for the plantation maintenance requirements and the minimum required frequencies.
O&M Manuals Requirements	● The tender documents should include a section for O&M manuals requirements, which require the inclusion of plantations.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Plantation List	● A comprehensive list of the available plantations at the Facility should be provided.
Maintenance Regime	● The plantation maintenance job plans and their frequencies should be provided.
Plantation Reports	● The plantation reports including the successful plantation, the required plants and the landscapes should be provided.
Job Plans	● A commitment to provide the job plans for the balance of the required three years should be made.

O&M Manuals	• (O&M) Manuals of the available plantations at the Facility should be provided.
Existing Building	
Criterion narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Plantation List	• A comprehensive list of the available plantations at the Facility should be provided.
Maintenance Regime	• The plantation maintenance job plans and their frequencies should be provided.
Condition Assessment	• A Condition Assessment of the existing plantation should be provided.
Job Plans	• The Signed Job Plans of plantation maintenance should be provided. • A commitment to provide these job plans for the balance of the required three years should be made.
O&M Manuals	• The (O&M) Manuals for the available plantations at the Facility should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.5.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 7.4.5-3. Factors and Weight factors for each Parameter

Parameter	Parameter No (i)	Min PM Frequency is Achieved	Factor “F_i”	Weight Factor “WF_i”
Area Wide General Landscape				
Picking litter	1	Yes / No	1 / 0	3
Removing fallen leaves	2	Yes / No	1 / 0	3

Trees				
Inspecting trees for damage and disease	3	Yes / No	1 / 0	5
Assessing dead/missing trees	4	Yes / No	1 / 0	5
Replacing failed trees	5	Yes / No	1 / 0	5
Applying weed control around each tree	6	Yes / No	1 / 0	3
Watering	7	Yes / No	1 / 0	2
Re-firming	8	Yes / No	1 / 0	3
Ensuring pest and disease control	9	Yes / No	1 / 0	3
Pruning	10	Yes / No	1 / 0	3
Fertilizing	11	Yes / No	1 / 0	3
Maintaining of Mulch	12	Yes / No	1 / 0	3
Hedgerows and Vines				
Assessing dead/missing plants	13	Yes / No	1 / 0	5
Replacing failed plantation	14	Yes / No	1 / 0	5
Applying weed control to all plants	15	Yes / No	1 / 0	3
Watering	16	Yes / No	1 / 0	2
Re-firming	17	Yes / No	1 / 0	3
Ensuring pest and disease control	18	Yes / No	1 / 0	3
Pruning / Shaping	19	Yes / No	1 / 0	3
Fertilizing	20	Yes / No	1 / 0	3
Shrubs and Groundcovers				
Assessing dead/missing plants	21	Yes / No	1 / 0	5
Replacing failed plantation	22	Yes / No	1 / 0	5
Applying weed control to all plants	23	Yes / No	1 / 0	3
Watering	24	Yes / No	1 / 0	2
Aerating the soil	25	Yes / No	1 / 0	3
Ensuring pest and disease control	26	Yes / No	1 / 0	3
Pruning / Shaping	27	Yes / No	1 / 0	3
Fertilizing	28	Yes / No	1 / 0	3
Grass and Amenity Grass				
Mowing	29	Yes / No	1 / 0	3
Fertilizing	30	Yes / No	1 / 0	3
Seeding	31	Yes / No	1 / 0	3

In order to determine the criterion score, the following formula is applied only for the plantation types which exist at the Facility, or else the section is omitted:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{31} \quad (F_i * WF_i)}{\sum_{i=1}^{31} \quad WF_i}\right]$$

A project earns a score of 100% if the minimum PM frequency is achieved for every existing plantation type found at the Facility. For every plantation type at the Facility, ensure that

- The maintenance requirements are included in the (O&M) manuals.
- The frequency of the implemented Preventive Maintenance (PM) job plans is equal to or lower than the required frequencies.

7.4.6 Si-4.6: Grounds Maintenance Regime

7.4.6.1 Criterion Reference and Title

Si-4.6: Grounds Maintenance Regime

7.4.6.2 Criterion Type

Optional

7.4.6.3 Intent

(1) To maintain the outdoor grounds and the infrastructure systems at the Facility at their optimal performance, to preserve the condition of these assets, to prolong their life, and to eliminate early replacements. (2) To reduce water and energy consumption due to poor maintenance, and to reduce material consumption due to early replacements.

7.4.6.4 General Requirements

Develop Operation and Maintenance (O&M) manuals and a Maintenance Regime for the following grounds and infrastructure systems if installed at the Facility.

Table 7.4.6-1. Grounds and Infrastructure Systems

Manual gates	Water supply wells
Electrically-operated gates	Elevated water storage tanks
Barriers	Fire hydrants
Fences	
Substations	Directional signs
Electrical distribution network	Exit signs
Electrical distribution boards	Security access system
Exterior lighting	CCTV
Gas distribution network	Mold remediation
Gas tanks	Exterior cladding
Gas detection system	Roof covering
Diesel distribution network	Windows
Diesel tanks	Shutters
	Ventilation louvers

Area drains	Pavements
Steel gratings	Roads
Storm drainage network	Walkways
Trenches	Planter boxes
Water ponds	Patios
Reservoirs	Handicap ramps
Geotextile for subsurface drainage	Parking lots
Drainage network	
Polyethylene septic tanks	
Concrete septic tanks	
Utility tunnels	
Utility tunnels drainage	

Maintenance Regime

Develop a maintenance regime for every ground and infrastructure system at the Facility including, but not limited to, the above systems.

The maintenance regime development process [1] starts first by identifying the list of assets which constitute each system and which will receive asset care, and then moves on to define the Preventive Maintenance (PM) job plans for each type of assets, and ends by assigning a frequency for each PM job plan.

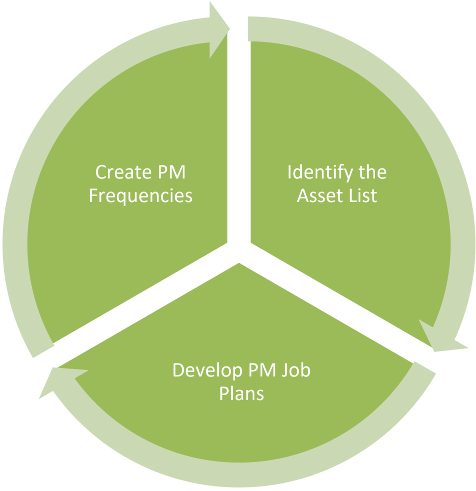


Figure 7.4.6-1. Maintenance Regime Development Process

Preventive Maintenance (PM) tasks, in general, fall under one of the following types of activities:

- Inspecting and identifying defects
- Cleaning, greasing, tightening
- Functional testing.

The Preventive Maintenance job (PM) plans shall be executed at a frequency which is equal to or lower than the list of minimum acceptable frequencies hereunder (as per the industry best practices, and RS Means Cost Planning and Estimating for Facilities Maintenance [2]).

These frequencies are the maximum acceptable frequencies for grounds or infrastructure system.

Table 7.4.6-2. Minimum Acceptable PM Frequencies

System	Minimum Acceptable PM Frequencies
Manual gates	Every 6 Months
Electrically operated gates	Every 6 Months
Barriers	Every 6 Months
Fences	Every 6 Months
Substations	Yearly
Electrical distribution network	Yearly
Electrical distribution boards	Yearly
Exterior lighting	Every 6 Months
Gas distribution network	Yearly
Gas tanks	Yearly
Gas detection system	Yearly
Diesel distribution network	Yearly
Diesel tanks	Yearly
Area drains	Yearly
Steel gratings	Yearly
Storm drainage network	Yearly
Trenches	Yearly
Water ponds	Yearly

Reservoirs	Yearly
Geotextile for subsurface drainage	Every 5 Years
Drainage network	Yearly
Polyethylene septic tanks	Yearly
Concrete septic tanks	Yearly
Utility tunnels	Yearly
Utility tunnels drainage	Yearly
Water supply wells	Yearly
Elevated water storage tanks	Yearly
Fire hydrants	Yearly
Directional signs	Yearly
Exit signs	Every 6 Months
Security access system	Every 6 Months
CCTV	Every 6 Months
Mold remediation	Yearly
Exterior cladding	Yearly
Roof covering	Yearly
Windows	Yearly
Shutters	Yearly
Ventilation louvers	Yearly
Pavements	Yearly
Roads	Yearly
Walkways	Yearly
Planter boxes	Yearly
Patios	Yearly
Handicap ramps	Yearly
Parking lots	Yearly

Demonstrate that maintenance is being applied as per the maintenance regime. The maintenance regime must be executed, and the Facility should hold documented evidence for that. The minimum required tasks include filling job plans and check lists, dating them and having them signed by the maintenance supervisor. The job plans and dates must reflect the tasks and frequencies as dictated by the maintenance regime.

New Building
Provide a commitment to submit necessary records for three consecutive years, starting no later than the date of applying for certification.

Existing Building
Provide necessary records for three consecutive years, which could refer to the three post-certification years, or to the past three years, if available, or any combination of past and future years provided that the three years are consecutive. In case of a post-certification record submittal, a prior binding commitment is required.

For an existing building, a condition assessment of the existing grounds and infrastructure systems should be conducted by a qualified individual or entity, who is certified in Facility management from an industry recognized certification body, or who holds a degree in engineering, and has a minimum of 8 years of experience in Facility management. The asset condition survey shall follow the guidelines of CIBSE Guide M chapter 14 of the 2014 edition. [3]

<u>Operation and Maintenance Manuals</u>

Develop Operation and Maintenance manuals (O&M) for each of the above systems which are installed in the Facility.

The (O&M) manuals are pivotal to enable the operation and maintenance team to provide the needed preventive, corrective, and predictive maintenance to the installed systems. Their purpose is to consolidate and explain what systems are installed, how they are configured, operated, and maintained. [4]

The Operation and Maintenance (O&M) manuals shall include, at a minimum, the following data: [4]

- As-built Drawings and Approved Material Submittals
- Original Equipment Manufacturer (OEM) Engineering manuals, Operation and Maintenance manuals, Spare Parts manuals
- Installation requirements

- Start-up requirements
- Site Configuration Procedures, i.e. how the systems must be configured in normal operation.
- Standard Operating Procedures (SOPs)
- Emergency Operating Procedures (EOPs). (This is to be applied during a breakdown, or other abnormal event, in order to restore the operation to as close as could be to design conditions, and stop further deterioration of the systems.
- Maintenance Regime as defined earlier
- Studies (e.g., soils, structural, electrical, mechanical, breaker, circuit, etc.)
- Commissioning Reports
- Warranty certificates (including any support agreements)
- Systems' sequence of operation
- Recommended spare parts inventory items
- A process to continuously update the Operation and Maintenance (O&M) manuals as changes are introduced to the system configurations, the settings, etc., or after component replacements, repairs, etc.

The aforementioned requirements for (O&M) manuals are common among the following criteria:
Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4.

Computer Aided Facility Management System (CAFM)

Implement a Computer Aided Facility Management system to direct, control, and document the maintenance activities at the Facility.

A Computer Aided Facility Management system stores the Facility asset register, the maintenance activities, the utility meter readings, the historical breakdowns and repairs, and the upgrades and replacements. Therefore, the CAFM forms a management information system for the Facility. [1]

The CAFM shall have the following minimum requirements [1]:

- Asset Registry (The asset registry stores information, such as the main features, the name plate information, the specifications, the date in service, the warranty details, the vendors, etc.)
- Work Orders (The work orders include planning jobs, allocating personnel, booking needed material and tools, tracking costs.)

- Preventive Maintenance (The Preventive Maintenance (PM) is about scheduling and automatically issuing future work orders once the period from last intervention date is reached.)
- Emergency Work Orders
- Service Requests
- Inventory Control
- Reporting

The aforementioned requirements for CAFM are common among the following criteria: Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4.

7.4.6.5 Special Requirements

None

7.4.6.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.4.6-2. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Maintenance Requirements	● The tender documents shall include a section which specifies the maintenance requirements of the grounds and infrastructure systems and the minimum required frequencies.
Operation and Maintenance (O&M) Manuals Requirements	● The tender documents shall include a section which shows that the Operation and Maintenance (O&M) manuals' requirements meet the minimum requirements.
Computer-Aided Facility Management (CAFM) Requirements	● The tender documents shall include a section which shows that the Computer-Aided Facility Management (CAFM) requirements meet the minimum features.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Assets List	● A comprehensive list of the assets of the grounds and infrastructure systems, which are installed at the Facility, should be provided.
Maintenance Regime	● The Preventive Maintenance (PM) job plans of the grounds and infrastructure systems and their frequencies should be provided.
Commissioning Reports	● The Commissioning Reports of the grounds and infrastructure systems should be provided
Job Plans	● A commitment to provide these job plans for the balance of the required three years should be made.
Operation and Maintenance (O&M) Manuals	● The Operation and Maintenance (O&M) manuals should be provided for the grounds and infrastructure systems installed at the Facility and meeting the minimum requirements.
Computer-Aided Facility Management (CAFM)Information	● The Computer-Aided Facility Management (CAFM) shall include information, such as the name, the version, and the features which satisfy the minimum requirements.
Computer-Aided Facility Management (CAFM) Generated Documents	● The Computer-Aided Facility Management (CAFM) shall include the generated documents of the asset registry, the work order list, the inventory items' list, the PM job plans, and their frequencies.
Existing Building	
Criterion narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Asset List	● A comprehensive Asset List of the grounds and infrastructure systems, which are installed at the Facility, should be provided.
Maintenance Regime	● The Preventive Maintenance (PM) job plans of the grounds and infrastructure systems and their frequencies should be provided.
Condition Assessment	● A Condition Assessment of the grounds and the infrastructure systems should be provided.
Job Plans	● The executed Preventive Maintenance (PM) job plans of the grounds and infrastructure systems should be signed and dated by the inspector. A commitment to provide these job plans for the balance of the required three years is necessary.
Operation and Maintenance (O&M) Manuals	● The Operation and Maintenance (O&M) manuals should be provided for the grounds and infrastructure systems installed at the Facility and meeting the minimum requirements.

Computer-Aided Facility Management (CAFM)Information	- The Computer-Aided Facility Management (CAFM) shall include information, such as the name, the version, and the features which satisfy the minimum requirements.
Computer-Aided Facility Management (CAFM) Generated Documents	- The Computer-Aided Facility Management (CAFM) shall include the generated documents of the asset registry, the work order list, the inventory items' list, the PM job plans, and their frequencies.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.6.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 7.4.6-3. Factors and Weight factors for each Parameter

Parameter	Parameter No (i)	Min PM Frequency is Achieved	Factor "F_i"	Weight Factor "WF_i"
Manual Gates	1	Yes / No	1 / 0	3
Electrically Operated Gates	2	Yes / No	1 / 0	3
Barriers	3	Yes / No	1 / 0	3
Fences	4	Yes / No	1 / 0	2
Substations	5	Yes / No	1 / 0	5
Electrical Distribution Network	6	Yes / No	1 / 0	5
Electrical Distribution Boards	7	Yes / No	1 / 0	5
Exterior Lighting	8	Yes / No	1 / 0	2
Gas Distribution Network	9	Yes / No	1 / 0	5
Gas Tanks	10	Yes / No	1 / 0	5
Gas Detection System	11	Yes / No	1 / 0	5
Diesel Distribution Network	12	Yes / No	1 / 0	4

Diesel Tanks	13	Yes / No	1 / 0	4
Area Drains	14	Yes / No	1 / 0	3
Steel Gratings	15	Yes / No	1 / 0	3
Storm Drainage Network	16	Yes / No	1 / 0	3
Trenches	17	Yes / No	1 / 0	3
Water Ponds	18	Yes / No	1 / 0	5
Reservoirs	19	Yes / No	1 / 0	5
Geotextile for Subsurface Drainage	20	Yes / No	1 / 0	5
Drainage Network	21	Yes / No	1 / 0	5
Polyethylene Septic Tanks	22	Yes / No	1 / 0	5
Concrete Septic Tanks	23	Yes / No	1 / 0	5
Utility Tunnels	24	Yes / No	1 / 0	5
Utility Tunnels Drainage	25	Yes / No	1 / 0	5
Water Supply Wells	26	Yes / No	1 / 0	5
Elevated Water Storage Tanks	27	Yes / No	1 / 0	5
Fire Hydrants	28	Yes / No	1 / 0	5
Directional Signs	29	Yes / No	1 / 0	4
Exit Signs	30	Yes / No	1 / 0	4
Security Access System	31	Yes / No	1 / 0	4
CCTV	32	Yes / No	1 / 0	4
Mold Remediation	33	Yes / No	1 / 0	5
Exterior Cladding	34	Yes / No	1 / 0	5
Roof Covering	35	Yes / No	1 / 0	5
Windows	36	Yes / No	1 / 0	4
Shutters	37	Yes / No	1 / 0	4
Ventilation Louvers	38	Yes / No	1 / 0	4
Pavements	39	Yes / No	1 / 0	4
Roads	40	Yes / No	1 / 0	4
Walkways	41	Yes / No	1 / 0	4
Planter Boxes	42	Yes / No	1 / 0	4

Patios	43	Yes / No	1 / 0	4
Handicap Ramps	44	Yes / No	1 / 0	5
Parking Lots	45	Yes / No	1 / 0	3

If the system is covered in the (O&M) manual and managed by a CAFM as described above, then $OM_i = 1$, else $OM_i = 0$.

In order to determine the criterion score, the following formula is applied <u>only for the Systems which are installed at the Facility</u>, or <u>else the system is omitted</u>:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{45} \quad (F_i * WF_i * OM_i)}{\sum_{i=1}^{45} \quad WF_i}\right]$$

A project earns a score of 100% if the minimum PM Frequency is achieved for every system installed at the Facility, i.e., for every ground or infrastructure system installed at the Facility,

- The frequency of the Preventive Maintenance (PM) activities is equal to or lower than the required frequencies.
- The system's details are included in the (O&M) manuals and meet the indicated requirements.
- The system's maintenance is managed through a CAFM and meets the indicated requirements.

7.4.7 Si-4.7: Emissions Measurements

7.4.7.1 Criterion Reference and Title

Si-4.7: Emissions Measurements

7.4.7.2 Criterion Type

Optional

7.4.7.3 Intent

To monitor and control the direct emissions from On-site electric generators and burners to acceptable levels. To reduce the amount of dangerous smog and pollutants in the air.

7.4.7.4 General Requirements

Develop a maintenance plan, as part of the Facility maintenance regime, (1) to measure the emissions from all the On-site electric generators and burners, and (2) to apply the necessary corrective measures when needed. The frequency of emission measurement shall be during the commission of the New Building, and at least once every two years, and preferably per annum, which will provide a higher score for the Existing Building. The minimum parameters to be measured shall be NO_x (mg/m^3), CO (mg/m^3), and Particulate Matter (mg/m^3).

The acceptable limits for these parameters are listed in the table hereunder for each system:

Table 7.4.7-1. Acceptable Emission Limits

System	Parameter					
	NO_x (mg/m^3)		CO (mg/m^3)		Particulate Matter (mg/m^3)	
	Target	High Limit	Target	High Limit	Target	High Limit
On-Site Electric Generator	<= 200	300	0	250	0	20
Oil Burner	<= 34	138	0	29	0	0
Gas Burner	<= 123	221	0	60	0	20

The above figures are derived from the EN676 requirements for Burners and the Lebanese Ministry of Environment Decree 1/8 30/1/2001 requirements for On-site Electric Generators.

7.4.7.5 Special Requirements

None

7.4.7.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.4.7-2. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Cx Specifications	● Commissioning specifications shall request that the emissions from the On-site electric generators and burners be measured and be within acceptable limits.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Asset List	● An Asset List of all the On-site electric generators and burners should be provided.
Emission Measurement Job Plans and Frequencies	● The Job Plans to measure the emissions of the electric generators and burners On-site should be provided along with their frequencies.
Emission Measurement Cx Reports	● Emission Commissioning Reports demonstrating that the values of the emission parameters are acceptable.
Signed Job Plans	● A commitment to provide, for the balance of the required three years, the emission measurement Job Plans signed.
Existing Building	
Criterion narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Asset List	● An Asset List of all the On-site electric generators and burners should be provided.
Emission Measurement Job Plans and Frequencies	● The Job Plans to measure the emissions of the electric generators and burners On-site should be provided along with their frequencies.

Signed Job Plans	- A commitment to provide, for the balance of the required three years or at least the current year, the Job Plans of emission measurement signed.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.7.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 7.4.7-2. Factors and Weight factors for each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Generator Emissions				
How frequent are the On-site generators' emission measurements?	1	Annual / Every 2 years / Not at all	1 / 0.5 / 0	3
Are corrections implemented after measurements?	2	Yes / No	1 / 0	3
What was the latest value of the following parameters (average of all the exhaust measured within the frame of the last two years)?				
NOx (mg/m^3)	3	V_3	F_3	5
CO (mg/m^3)	4	V_4	F_4	5
Particulate Matter (mg/m^3)	5	V_5	F_5	5
Gas Burner Emissions				
How frequent are the On-site gas burners' emission measurements?	6	Annual / Every 2 years / Not at all	1 / 0.5 / 0	3

Are corrections implemented after measurements?	7	Yes / No	1 / 0	3
What was the latest value of the following parameters (average of all the exhaust measured within the frame of the last two years)?				
NOx (mg/m^3)	8	V_8	F_8	5
CO (mg/m^3)	9	V_9	F_9	5
Particulate Matter (mg/m^3)	10	V_{10}	F_{10}	5
Oil Burner Emissions				
How frequent are the On-site oil burners' emission measurements?	11	Annual / Every 2 years / Not at all	1 / 0.5 / 0	3
Are corrections implemented after measurements?	12	Yes / No	1 / 0	3
What was the latest value of the following parameters (average of all the exhaust measured within the frame of the last two years)?				
NOx (mg/m^3)	13	V_{13}	F_{13}	5
CO (mg/m^3)	14	V_{14}	F_{14}	5
Particulate Matter (mg/m^3)	15	V_{15}	F_{15}	5

The aforementioned factors are calculated using the tables hereunder.

Table 7.4.7-3. Factor F_3 Values

V_3	F_3
$< = 200$ mg/m^3	1
$> = 300$ mg/m^3	0
200 mg/m^3 $\leq V_3 \leq$ 300 mg/m^3	$(300 - V_3) / (300 – 200)$

Table 7.4.7-4. Factor F_4 Values

V_4	F_4
= 0 mg/m^3	1
$> = 250$ mg/m^3	0
0 mg/m^3 $\leq V_4 \leq$ 250 mg/m^3	$(250 - V_4) / 250$

Table 7.4.7-5. Factor F_5 Values

V_5	F_5
= 0 mg/m^3	1
$> = 20$ mg/m^3	0
0 mg/m^3 $\leq V_5 \leq$ 20 mg/m^3	$(20 - V_5) / 20$

Table 7.4.7-6. Factor F_8 Values

V_8	F_8
$< = 34$ mg/m^3	1
$> = 138$ mg/m^3	0
34 mg/m^3 $\leq V_8 \leq$ 138 mg/m^3	$(138 - V_8) / (138 – 34)$

Table 7.4.7-7. Factor F_9 Values

V_9	F_9
= 0 mg/m^3	1
> = 29 mg/m^3	0
0 mg/m^3 $\leq$ V_9 $\leq$ 29 mg/m^3	(29 - V_9) / 29

Table 7.4.7-8. Factor F_{10} Values

V_{10}	F_{10}
= 0 mg/m^3	1
else	0

Table 7.4.7-9. Factor F_{13} Values

V_{13}	F_{13}
< = 123 mg/m^3	1
> = 221 mg/m^3	0
123 mg/m^3 $\leq$ V_{13} $\leq$ 221 mg/m^3	(221 - V_{13}) / (221 – 123)

Table 7.4.7-10. Factor F_{14} Values

V_{14}	F_{14}
= 0 mg/m^3	1
> = 60 mg/m^3	0
0 mg/m^3 $\leq$ V_{14} $\leq$ 60 mg/m^3	(60 - V_{14}) / 60

Table 7.4.7-11. Factor F_{15} Values

V_{15}	F_{15}
= 0 mg/m^3	1
> = 20 mg/m^3	0
0 mg/m^3 ≤ V_{15} ≤ 20 mg/m^3	(20 - V_{15}) / 20

In order to determine the criterion score, the following formula is applied only for the Systems which are installed at the Facility, or else the system is omitted:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{15} \quad (F_i * WF_i)}{\sum_{i=1}^{15} \quad WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements, where emissions are measured at least annually and are kept below or equal to the low limits.

7.4.8 Si-4.8 : Pollution Prevention of Maintenance Activities

7.4.8.1 Criterion Reference and Title

Si-4.8: Pollution Prevention of Maintenance Activities

7.4.8.2 Criterion Type

Optional

7.4.8.3 Intent

To actively prevent pollution resulting from maintenance activities, specifically from the storage and handling of refrigerants, lubricants, and fuels. To safeguard water quality, and to reduce global warming due to refrigerant release into the environment.

7.4.8.4 General Requirements

Develop and implement Standard Operating Procedures (SOPs) for the storage and/or the handling of the following pollutants during maintenance activities:

- Refrigerants
- Lubricants
- Equipment Wash Water
- Fuel

The refrigerant Standard Operating Procedures (SOPs) shall mandate refrigerant recovery for the purpose of air-conditioning systems repairs. Direct release of refrigerants into the atmosphere shall be prohibited.

The Lubricants' Standard Operating Procedures (SOPs) shall include the following requirements:

- Locate equipment on sealed bases such that leaks are not absorbed through the slabs or the ground.
- Provide a drip pan under the leaking parts until the leak is corrected.
- Schedule regular emptying and cleaning of drip pans.
- Use lubricant absorbent pads to clean leaks or spills.
- Properly label and seal containers of used lubricants. Provide containment for waste tanks. Properly dispose used lubricants and contaminated waste.
- Train maintenance staff and concerned employees on the Lubricant SOPs.

Equipment wash is another source of grease and lubricant contamination from maintenance activities. The equipment washing SOP shall include the following requirements:

- Properly contain the wash area to avoid wash water from entering drains.
- Use biodegradable detergents.
- Construct a designated washdown area connected to an oil and grease inceptor. No maintenance activities or lube changes are allowed in that area.
- Collect and recycle wash water.
- Use an Off-site properly operated commercial cleaning service, where possible.
- Train maintenance staff and concerned employees on the equipment washing SOP.

The fuel storage and fueling SOP shall include the following requirements:

- Provide a containment around the fuel storage tanks. The containment shall have a volume at least 120% of the stored volume.
- Perform the required Preventive Maintenance (PM) for tanks and transfer equipment.
- Cover storage and fueling areas to prevent contamination of stormwater runoffs.
- Place drip pans under fueling connection points.
- Train concerned employees on proper fueling techniques and spill response.

General additional requirements:

- All drains shall be marked with "No Dumping" signage.
- Post instructional signage reflecting the SOPs.
- Any leaking or cracked batteries shall be stored in secondary containers, until they are properly disposed.

Develop and implement a Spill Emergency Response (SER) plan. The Spill Emergency Response plan shall include the following requirements:

- Immediately stop the source of the spill.
- Deploy absorbent booms or other proper material to contain the spill and prevent it from reaching the drains.
- Use lubricant absorbent pads or other proper material to clean leaks or spills.
- Properly dispose the used containment and clean-up materials.
- Document the root cause of the spill, and implement corrective actions to prevent similar future incidents.

Implement a training program to be conducted for at least every two years. Spill Emergency Response drills shall be performed annually. The training shall be provided by a qualified individual or entity, who is certified in environmental health and safety, or Facility management, from an industry recognized certification body, or who holds a degree in Engineering and has a minimum of 8 years of experience in environmental health and safety or Facility management.

7.4.8.5 Special Requirements

None

7.4.8.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 7.4.8-1. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Refrigerant Recovery Unit	● A section of the specifications should include the request for the provision of a refrigerant recovery unit.
Operation and Maintenance (O&M) Specifications	● The section of the Operation and Maintenance (O&M) specifications which requests SOPs for refrigerant recovery, lubricant handling, equipment wash water containment, fuel storage and fueling.
Typical Equipment Bases and Drip Pan Details	● The typical details of Equipment Bases should indicate the type of sealing and drip pans (where needed).
Typical Containment Details	● The typical details of fuel tank containment, fueling drip pans, waste tank containment, and area containment should be provided.
Recommended Spill Kit Requirements	● The list of requirements of the recommended spill kits should be provided.
Signage	● The typical details of no dumping signage, instructional signage, wash area signage, waste tanks signage, etc. should be provided.
Typical Washdown Area Details	● The typical details of the washdown area and the drain piping to the oil and grease interceptor should be provided.
Spill Emergency Response Plan (ERP)	● The outline of the Spill Emergency Response Plan should be provided.
Training programs	● The outline of the training programs for each SOP and for the spill Emergency Response Plan should be provided.

New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Refrigerant Handling SOP	● A Refrigerant Handling SOP should be provided.
Lubricant Storage and Handling SOP	● The Lubricant Storage and Handling SOP should be provided.
Equipment Wash Water SOP	● The Equipment Wash Water SOP should be provided.
Fuel Storage and Fueling SOP	● The Fuel Storage and Fueling SOP should be provided.
Spill Emergency Response Plan	● The Spill Emergency Response Plan should be provided.
Refrigerant Recovery Unit	● The datasheet of the On-site refrigerant recovery unit should be provided.
As-built Drawings of Equipment Bases and Drip Pans	● The As-built Drawings should show the details of equipment bases, and should indicate the type of sealings and drip pans (where needed).
Details of Available Spill Kits	● The list of available spill kits and their datasheets should be provided.
As-built Drawings of Different Containments	● The As-built Drawings should show the details of fuel tank containments, fueling drip pans, waste tank containments, and wash area containments.
Signage	● The Photos showing the installed signage: No-Dumping signage, instructional signage, wash area signage, waste tank signage, etc. should be provided.
As- built Drawings of Washdown Area.	● The As- built Drawings should show the details of the washdown area and the drainage to the oil and grease interceptor.
Manufacturer Datasheets of Detergents	● The Manufacturer Datasheets of the detergents which are used should be provided.
Wash Water Recycling	● The procedure of Wash Water Recycling and the percentage of recycled wash water should be provided.
MOU for Wash Service	● The Memorandum of Understanding (MOU) with an Off-site properly-operated commercial cleaning service should be provided.
Preventive Maintenance Plan of Fuel Tanks and Fueling / Transfer Equipment	● The Job plan should (1) detail the Preventive Maintenance (PM)service of fuel tanks and fueling / transfer equipment, and (2) indicate the PM frequency.

Training programs	● The content of the training programs for each Standard Operating Procedure (SOP) and for the spill Emergency Response Plan (ERP)should be submitted.
Training Attendance Sheets	● The Attendance Sheets of each training session should indicate the date and the scope of the training, and the name, the position, and the signature of each attendee.
Existing Building	
Criterion Narrative	● Criterion narrative should give a brief description of the strategy implemented by the project team to meet this criterion requirements.
Refrigerant Handling SOP	● The Refrigerant Handling SOP should be provided.
Lubricant Storage and Handling SOP	● The Lubricant Storage and Handling SOP should be provided.
Equipment Wash Water SOP	● The Equipment Wash Water SOP should be provided.
Fuel Storage and Fueling SOP	● The Fuel Storage and Fueling SOP should be provided.
Spill Emergency Response Plan	● The Spill Emergency Response Plan should be provided.
Refrigerant Recovery Unit Datasheet	● The Manufacturer Datasheet of the On-site refrigerant recovery unit should be provided.
As- built Drawings of Equipment bases and drip pans	● The As- built Drawings should show the details of the equipment bases, and should indicate the type of sealings and drip pans (where needed).
Datasheets of Available Spill Kits	● The list of available spill kits and their datasheets should be provided.
As- built Drawings of Different Containments	● The As-built Drawings should show the details of fuel tank containments, fueling drip pans, waste tank containments, and wash area containments.
Signage	● The Photos showing the installed signage: No-Dumping signage, instructional signage, wash area signage, waste tank signage, etc. should be provided.
As- built Drawings of Washdown Area	● The As- built Drawings should show the details of the washdown area, and the drainage to the oil and grease interceptor.
Datasheets of Detergents	● The Manufacturer Datasheets of the detergents which are used should be provided.
Wash water recycling	● The procedure of wash water recycling and the percentage of recycled wash water should be provided.

MOU for Wash Service	● The Memorandum of Understanding (MOU) with an Off-site properly-operated commercial cleaning service should be provided.
Preventive Maintenance Plan of Fuel tanks and fueling / transfer equipment	● The Job plan should (1) detail the Preventive Maintenance (PM)service of fuel tanks and fueling / transfer equipment, and (2) indicate the PM frequency.
Training programs	● The Content of the training programs for each SOP and for the spill Emergency Response Plan (ERP) should be provided.
Training Attendance Sheets	● The Attendance Sheets of each training session should indicate the date and the scope of the training, and the name, the position, and the signature of each attendee.
Spill Root Cause Reports	● The Analysis reports of the root cause of all past spill incidents and the adequate remedies should be provided.
Spill Emergency Response Drills	● The record of the Spill Emergency Response Drills should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.8.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 7.4.8-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
The Facility has a Standard Operating Procedure (SOP) for Refrigerant Recovery during maintenance activities.	1	Yes / No	1 / 0	3
The Facility owns a refrigerant recovery unit.	2	Yes / No	1 / 0	5
The Facility has a Standard Operating Procedure (SOP) for handling lubricants during maintenance activities.	3	Yes / No	1 / 0	3

Is the following covered by the SOP?				
Locate the equipment on sealed bases such that leaks are not absorbed through the slabs or the ground.	4	Yes / No	1 / 0	5
Provide a drip pan under the leaking parts until the leak is corrected.	5	Yes / No	1 / 0	1
Schedule regular drip pan emptying and cleaning.	6	Yes / No	1 / 0	2
Use lubricant absorbent pads to clean leaks or spills.	7	Yes / No	1 / 0	5
Properly label and seal containers of used lubricants. Provide containment for waste tanks. Properly dispose used lubricants and contaminated waste.	8	Yes / No	1 / 0	5
Train maintenance staff and concerned employees on the Lubricant SOP.	9	Yes / No	1 / 0	5
Instructional signage is properly posted in machine rooms, washdown areas, fuel storage and fueling areas, and waste storage areas, and on refrigeration units, and drains.	10	Yes / No	1 / 0	5
The Facility has a Standard Operating Procedure (SOP) for Equipment Washing / Steam Cleaning.	11	Yes / No	1 / 0	5
Is the following covered by the SOP?				
Properly contain the wash area to avoid wash water from infiltrating in the drains.	12	Yes / No	1 / 0	5
Use biodegradable detergents.	13	Yes / No	1 / 0	5
Construct a designated washdown area connected to an oil and grease inceptor. No maintenance activities or lube changes are allowed in that area.	14	Yes / No	1 / 0	5
Collect and recycle wash water.	15	Yes / No	1 / 0	5
Use an Off-site properly-operated commercial cleaning service, where possible.	16	Yes / No	1 / 0	5
Train maintenance staff and concerned employees on the Wash SOP.	17	Yes / No	1 / 0	5

Store leaking or cracked batteries in secondary containers and dispose of them properly.	18	Yes / No	1 / 0	3
The Facility has a Standard Operating Procedure (SOP) for fuel storage and fueling activities.	19	Yes / No / Not Applicable	1 / 0 / --	3
Is the following covered by the SOP?				
Provide a containment around fuel storage. The containment shall have a volume at least 120% of the stored volume.	20	Yes / No	1 / 0	3
Perform the required Preventive Maintenance (PM) for tanks and fueling / transfer equipment.	21	Yes / No	1 / 0	3
Cover storage and fueling areas to prevent contamination of stormwater runoffs.	22	Yes / No	1 / 0	5
Place drip pans under fueling connection points.	23	Yes / No	1 / 0	5
Train concerned employees on proper fueling techniques and spill response.	24	Yes / No	1 / 0	5
The Facility has a spill Emergency Response Plan (ERP).	25	Yes / No	1 / 0	5
Is the following covered by the ERP?				
Immediately stop the source of the spill.	26	Yes / No	1 / 0	2
Deploy absorbent booms or other proper material to contain the spill and prevent it from reaching the drains.	27	Yes / No	1 / 0	2
Use lubricant absorbent pads or other proper material to clean leaks or spills.	28	Yes / No	1 / 0	5
Properly dispose of the containment and the clean-up materials.	29	Yes / No	1 / 0	5
Document the root cause of the spill, and implement corrective actions to prevent similar future incidents.	30	Yes / No	1 / 0	3

In order to determine the criterion score, the following formula is applied except for fuel storage unless fuel storage is installed at the Facility, or else the fuel storage section (parameter i= 19 to 24) is omitted:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{30} (F_i * WF_i)}{\sum_{i=1}^{30} WF_i}\right]$$

Where the following factors will be set to zero if the main requirement is not achieved:

Parameter	Parameter No (i)	If Status is	Then Factor "F_i"	Weight Factor "WF_i"
The Facility has a Standard Operating Procedure (SOP) for Refrigerant Recovery during maintenance activities.	1	No	0	3
The Facility owns a refrigerant recovery unit.	2		0	5
The Facility has a Standard Operating Procedure (SOP) for handling lubricants during maintenance activities.	3	No	0	3
Is the following covered by the SOP?				
Locate equipment on sealed bases such that leaks are not absorbed through the slabs or the ground.	4		0	5
Provide a drip pan under the leaking parts until the leak is corrected.	5		0	1
Schedule regular drip pan emptying and cleaning.	6		0	2
Use lubricant absorbent pads to clean leaks or spills.	7		0	5
Properly label and seal containers of used lubricants. Provide containment for waste tanks. Properly dispose used lubricants and contaminated waste.	8		0	5
Train maintenance staff and concerned employees on the Lubricant SOP.	9		0	5
The Facility has a Standard Operating Procedure (SOP) for Equipment Washing / Steam Cleaning.	11	No	0	5
Is the following covered by the SOP?				

Properly contain the wash area to avoid wash water from infiltrating in the drains.	12		0	5
Use biodegradable detergents.	13		0	5
Construct a designated washdown area connected to an oil and grease inceptor. No maintenance activities or lube changes are allowed in that area.	14		0	5
Collect and recycle wash water.	15		0	5
Use an Off-site properly-operated commercial cleaning service, where possible.	16		0	5
Train maintenance staff and concerned employees on the wash SOP.	17		0	5
The Facility has a Standard Operating Procedure (SOP) for fuel storage and fueling activities.	19	No	0	3
Is the following covered by the SOP?				
Provide a containment around the fuel storage. The containment shall have a volume at least 120% of the stored volume.	20		0	3
Perform the required Preventive Maintenance (PM) for tanks and fueling / transfer equipment.	21		0	3
Cover storage and fueling areas to prevent contamination of stormwater runoffs.	22		0	5
Place drip pans under fueling connection points.	23		0	5
Train concerned employees on proper fueling techniques and spill response.	24		0	5
The Facility has a spill Emergency Response Plan (ERP).	25	No	0	5
Is the following covered by the ERP?				
Immediately stop the source of the spill.	26		0	2
Deploy absorbent booms or other proper material to contain the spill and prevent it from reaching the drains.	27		0	2

Use lubricant absorbent pads or other proper material to clean leaks or spills.	28		0	5
Properly dispose of the containment and the clean-up materials.	29		0	5
Document the root cause of the spill and implement corrective actions to prevent similar future incidents.	30		0	3

A project earns a score of 100% by complying with each of the aforementioned requirements.

7.4.9 Si-4.9: Commissioning Management

7.4.9.1 Criterion Reference and Title

Si-4.9: Commissioning Management

7.4.9.2 Criterion Type

Optional

7.4.9.3 Intent

To ensure that the Facility is designed, constructed, and operated within a quality assurance process targeting intended Facility functionality, efficiency, and durability. To improve life safety, indoor air quality, water quality, and to reduce energy and water consumption, and pollutants emissions.

7.4.9.4 General Requirements

Commissioning is not an event but a process which should start from inception, i.e., when the Facility is still a concept. Commissioning intensity increases throughout the design and construction phases, and continues through the first year of operation. Commissioning is the optimal quality assurance process which ensures that the Facility operates at its optimal levels. [5]

While Commissioning is applied for New Construction, Retro-Commissioning and Re-Commissioning are applied for Existing Buildings.

An Existing Building, which has not gone through a commissioning process, is most probably not operating at its optimal levels. Retro-commissioning is required to bring the systems as close as possible to their optimal performance. Retro-commissioning has its own difficulties which differ from those encountered in commissioning.

The following highlights some of the difficulties encountered during Retro-commissioning [5]:

- Documentation of design parameters, updated drawings, and system data is incomplete or unavailable.
- Design and construction teams are not on board.
- System deficiencies exist due to age and maintenance quality.
- The occupied Facility raises issues of
    - Work interruption or occupant inconvenience
    - Risk of damage to furniture and stored items

- Security risk
- Retro-commissioning may be performed outside working hours to reduce disruptions. Access control and security are nonetheless required.

Commissioning Authority (CxA)

The Applicant shall select a Commissioning Authority (CxA) which reports directly to the Applicant / Owner Representative. The Commissioning Authority (CxA) can be an individual, or a firm, who will lead the commissioning process. The Commissioning Authority (CxA) shall be a qualified individual or entity, who holds a degree in electrical or mechanical engineering, and has a minimum of 10 years of experience in commissioning or Facility management. Up to 5 years of experience in Testing, Adjusting, and Balancing (TAB) can be considered towards the commissioning experience.

For New Buildings

The Pre-design Phase

- Develop the Owner's Project Requirements (OPR), which captures the functional requirements (the use) of the Facility, and the required quality standards (the required rating level). The Owner's Project Requirements (OPRs) includes design and operational goals, budgets, timeline, and other relevant documents which may give more guidance to the design team [5].

Commissioning Scope

The commissioning scope shall include the following systems:

- Safety Systems

The safety systems at the Facility include, but are not limited to, the following: fire alarms, fire pumps, water sprinklers, gas suppression systems, fire extinguishers, emergency and exit lighting, earthing system, lightening system, etc.

- Energy and Water Systems

The energy systems at the Facility include, but are not limited to, the following: HVAC systems, lighting and power systems, generators, boilers, water heating systems, water pumping systems, and all other systems using utilities, such as electric power, diesel, or gas, or systems which run on renewable sources. **This parameter is a pre-requisite for this criterion**.

➢ Generator Emission Validation

Generator emission validation versus the design requirements and applicable regulations

➢ Boiler Emission Validation

Boiler emission validation versus the design requirements and applicable regulations

➢ Site Noise Reduction

Noise measurements and validation versus the design requirements and applicable regulations

➢ Nightlight Pollution Reduction

Nightlight pollution validation versus the design requirements and applicable regulations

- Develop the scope and method of commissioning to identify which systems will undergo commissioning as part of the commissioning process. Document a communication flow.

- Develop a brief commissioning plan, which accounts for the sequential steps of the full commissioning (Cx) process.

- Select the commissioning team, who should be constituted of the Commissioning Authority (CxA), the Facility operations and the maintenance team, the Facility ultimate users or their representatives, and the design team, if selected [5].

- Develop the Basis of Design (BOD) document, which shall include the following, at a minimum [5]:
    - Selection of systems and systems' components
    - Codes and standards to be used
    - Maintainability requirements
    - Fire and life safety requirements
    - Assumptions.

Design Phase

- The Commissioning Authority (CxA) shall conduct a design review as per the pre-design phase commissioning (Cx) plan. The design review should be performed during the design phase, and before the release of the design for pricing, or for submittal to the construction contractor. It should be performed at three stages, at a minimum: first, the schematic drawing stage; second, the design development stage; and third, the tender document stage. At each stage of the review, the Commissioning Authority (CxA) shall check the drawings, the specifications, and the discipline coordination, and shall update both the Owner's Project Requirements (OPR) and the BOD [5].

- The commissioning (Cx) plan should be updated to the specific design which was completed, and should include a time schedule which will be adopted as an integral part of the overall schedule of the project.

- The commissioning specifications, which will form an integral part of the tender document, should be identified. The commissioning (Cx) specifications shall include the following sections, at a minimum [5]:

General Requirements' Section:
  - Responsibilities
  - Third parties
  - Systems under the commissioning scope
  - Required system testing
  - Submittals
  - O&M manuals' specifications
  - Commissioning (Cx) plan
  - Examples of required forms: checklists, interface wiring diagrams, and procedures.

Specific Requirements Section Per System Per Component
  - Static tests
  - Flushing and cleaning
  - Pre-installation checklist
  - Installation and startup checklist
  - Testing, Adjusting and Balancing (TAB) (where applicable)
  - Sequence of operation (where applicable)
  - Component Functional Performance Testing (FPT) for motors, relays, sensors, valves, etc.
  - System Functional Performance Testing (FPT)
  - Intersystem Functional Performance Testing (FPT)
  - Commissioning Test Procedures (CxTPs)
  - Required submittals.

Construction

- Integrate the commissioning schedule within the construction schedule. The following milestones shall be included in the schedule:
  - Material and shop drawings submittal dates
  - Installation verifications
  - Start-up
  - FPT
  - CXTP
  - O&M manuals' submittal
  - Training sessions per system.

- Like in the design review process, the Commissioning Authority (CxA) shall perform a review of material and shop drawings submittals for all the systems submittals, which are under the commissioning (Cx) scope. The end goal is to ensure that the construction complies with the requirements of the Owner's Project Requirements (OPRs), the design, and the commissioning (Cx) specifications.

- The Commissioning Authority (CxA) shall perform installation verification for each system and system component, which is under the commissioning (Cx) scope.

- The Commissioning Authority (CxA) shall perform a start-up acceptance of all system components, which are under the commissioning (Cx) scope, to confirm that their performance data are acceptable.

- The Commissioning Authority (CxA) shall review the control strategy including, but not limited to, the sequence of operation, the interface wiring diagrams, and the Building Management System (BMS) schedule of points.

- The Commissioning Authority (CxA) shall review and approve the systems' Operation and Maintenance manuals.

- Provide operator training to the operation and maintenance staff. The training should focus on the system operation in different system operating conditions: normal, seasonal, and emergency. Train the operation and maintenance staff on the system maintenance, the maintenance regime requirements, and the component replacements in case of breakdowns.

- Develop Commissioning Test Procedures (CxTPs) in compliance with the commissioning (Cx) specifications.

- Develop Functional Performance Testing (FPT) in compliance with the FPT specifications.

- Perform and verify Commissioning Test Procedures (CxTPs) and Functional Performance Testing (FPT). Produce CxTP reports and FPT reports, which shall clearly compare the measured data to the design data.

- The Commissioning Authority (CxA) shall provide an issue report (usually referred to as Snag List / Punch List) to the design team. It is understood that some deficiencies will continue to be reported until resolved during the warranty period.

Post-Handover / Occupancy (1year from Handover)

- Register system performance through trend-logging of operational data. These are either hourly or two-hour readings, which are registered manually, or through the Building Management System (BMS), if applicable, at every change of state.

- Since not all testing would have been usually completed at handover, the Commissioning Authority (CxA) shall perform seasonal post-handover testing.

- Before the warranty expires, the Commissioning Authority (CxA) shall perform an operational health check of the Facility, and shall submit an issue report to the construction contractor to correct the deficiencies, if any.

- The Commissioning Authority (CxA) shall optimize the operation of systems to meet the Facility's actual operational conditions. The actual operation may differ from what was planned; therefore, it is expected that fine-tuning of operational schedules, morning startups and evening shutdowns, lighting controls, and the like will be required [5] during the first year of operation.

- The Commissioning Authority (CxA) shall provide ongoing monitoring and advice to the Facility operational staff. This is a process of continual improvement as system operations drift overtime, and require fine-tuning. In some cases, due to repairs and replacements, fine-tuning will not be sufficient, and a recommission would be due. [5].

For Existing Building (Re-commissioning or Retro-commissioning)

Develop the Commissioning Scope and the Commissioning Plan

The Commissioning Authority (CxA) shall

- Establish the Owner's Project Requirements (OPRs). The owner might be struggling with specific issues, such as high energy consumption, or comfort issues, etc.

- Select the commissioning (Cx) team and identify the operations and maintenance staff, who will be part of this team. The involvement of the Owner's operations and maintenance staff in the commissioning (Cx) has three advantages: (1) the training the operations and maintenance staff are provided with, (2) the engagement and buy-in of the staff so that the commissioning (Cx) process does not come across as an outside audit of the operations and maintenance, and (3) the reduction in the cost of the commissioning (Cx) exercise. [5]

- Meet the operation and maintenance staff to gather their observations, and include their concerns in the commissioning (Cx) scope to implement a resolution. [5]

- Review the maintenance records of the Facility including, but not limited to, the Preventive Maintenance (PM) records, the Corrective Maintenance records, and the deferred Maintenance Work Orders to identify the anomalies to be corrected during commissioning (Cx).

- Evaluate historical energy consumption data for the past three years, where available, and identify areas of improvement. [5].

- Evaluate historical water consumption data for the past three years, where available, and identify areas of improvement.

- Conduct a walk-through of all the Facility spaces as part of the data collection, and issue identification tasks to update the commissioning (Cx) plan accordingly. [5]

- Meet with, at least, two occupants from each space you visit to gather their observations, and collect their concerns and feedback about the Facility operation, maintenance, comfort, etc. [5]

- Determine the commissioning activities' interference with the Facility activities, such as potential hazards to personnel and other liability issues. The commissioning (Cx) plan shall include mitigation measures to the identified disruption of the Facility operations during commissioning, and to the potential safety risks to occupants and / or equipment. [5]

- Identify the possible achievable system performance given the current system capabilities. Having reviewed the maintenance records and system performance data, the Commissioning Authority (CxA) will identify areas where systems have over or under capacities versus the actual use of the Facility. Remedies to these performances are required as part of the commissioning (Cx) plan. [5]

- Estimate the remaining lifetime of the different systems taking into consideration the equipment's current condition, the Original Equipment Manufacturer (OEM) spare parts' support for phased out equipment, the deterioration of the distribution system, or the obsolete controls. The Commissioning Authority (CxA) may recommend the delay of the commissioning of the systems which are reaching their end of life until after implementing the needed upgrades. [5]

- Identify the commissioning (Cx)scope.

- Develop the commissioning (Cx) plan considering the above findings collected from the interviews, the data review, and the Facility walk-through.

Individual Component Testing

The Commissioning Authority (CxA) shall

- Collect and review existing documentation about system installation, sequence of operation, Operation and Maintenance (O&M) manuals, etc. It shall also identify any missing elements of the Operation and Maintenance (O&M) manuals including any out-of-date sections due to alternations and modifications. The task of gathering documentation for an existing building is a cumbersome task, unlike a new construction where the designer and the contractor are still on board. [5]

- Seek missing documentation and information, such as the original design intent or basis of design, design documents, submittals, shop drawings and as-built drawings, etc., from alternative sources. [5]

- Improve the Facility documentation as required. It shall also engage relevant parties to update the existing documentation, and to provide the missing documentation by conducting Facility surveys and contacting the Original Equipment Manufacturers (OEMs).

- Establish test procedures for component testing.

- Mitigate potential risks during component testing. It shall also issue instructions to reduce disruption of works at the Facility, and to reduce risks to the equipment and the personnel, as part of the test procedures. [5]

- Inform occupants of any system interruptions during component testing, such as dates and times where systems will not be available, or services will suffer interruptions. [5]

- Conduct the component testing.

Issue the commissioning (Cx) report and recommendations based on individual component testing.

The CxA shall:

- Report the results of component testing
- Document the corrective maintenance, which was done during the testing
- Issue required corrective maintenance as needed
- Re-evaluate the possible achievable performance based on the observed systems' capacities
- Schedule any additional corrective maintenance, such as replacing defective components or duct cleaning, etc.
- Mitigate potential risks during the re-testing
- Inform occupants of any system interruptions during component re-testing
- Subcontract corrective maintenance whenever required
- Conclude post- repair component testing.

[5]

Systems Testing

The Commissioning Authority (CxA) shall conduct system testing after completing the component testing to ensure that all systems are functional as required. The Commissioning Authority (CxA) shall

- Establish system Functional Performance Test Procedures (FPTs)
- Mitigate potential risks related to FPTs
- Inform occupants of any system interruptions during FPTs
- Conduct FPTs
- Document the corrective maintenance, which was done during the FPTs
- Issue required corrective maintenance as needed
- Conduct Operation and Maintenance Training for Owner’s staff. [5]

Issue Draft Commissioning (Cx) Report

- The Commissioning Authority (CxA) shall discuss the results with the Owner, present an executive summary of the results and the future recommendations, and ensure the Owner’s satisfaction. [5]

Subcontract Corrective Maintenance or Modifications, if needed.

If additional corrective measures are needed to close all the Commissioning recommendations, the Commissioning Authority (CxA) shall

- Subcontract corrective maintenance or modifications
- Retest. [5]

Transfer the Facility to the Operations and Maintenance Staff

- The Commissioning Authority (CxA) shall provide the necessary training for the Operations and Maintenance staff to smoothen the transition of the Facility back to them, and to familiarize them with the new system settings, upgrades, and replaced components or equipment. It is a mini handover compared to that of a new building.

- The Commissioning Authority (CxA) shall
  - Train the Owner's operations staff to ensure operational sustainability
  - Include the test procedures and processes to ensure that the Facility remains tuned as per the commissioning process, and that the documentation remains up-to-date with future replacements and modifications.

The above should be delivered during an exit meeting with the Operation and Maintenance staff.

7.4.9.5 Special Requirements

None

7.4.9.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.4.9-1. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Commissioning Authority (CxA)	• Provide the name and the qualifications of the Commissioning Authority (CxA).
Contract with the Commissioning Authority (CxA)	• Include the required scope in the contract with the Commissioning Authority (CxA).
Owner’s Project Requirements (OPRs)	• Compile the OPR document in the design phase.
Scope and Method of Commissioning	• List the systems which will undergo commissioning, and then describe the communications’ flow and the commissioning (Cx) standard. • Design a brief commissioning plan.
Commissioning Team	• Provide the names and the qualifications of the commissioning (Cx) Team.
Basis of Design	• Set the basis of the design document.
Design Review reports (minimum at 3 stages of design development)	• The Commissioning Authority (CxA) should produce the design review document at three different stages in the design development:

	● The schematic drawing stage ● The design development stage ● The tender document stage.
Commissioning Plan	● Update the commissioning (Cx) Plan based on the developed design.
Commissioning Specifications	● Provide the commissioning specifications.
New Building in Construction Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Commissioning Authority	● Provide the name and the qualifications of the Commissioning Authority (CxA).
Contract with the CxA	● Provide a copy of the contract with the Commissioning Authority (CxA) showing the required scope.
Owner's Project Requirements (OPR)	● Update the OPR document.
Scope and Method of Commissioning	● List the systems which will undergo commissioning, and then describe the communications flow and the commissioning (Cx) standard. ● Provide a brief commissioning plan.
Commissioning Team	● Provide the names and qualifications of the commissioning (Cx) team.
Basis of Design	● Set the basis of the design document.
Integrated commissioning (Cx) Schedule	● Integrate the tasks of the commissioning (Cx) schedule in the construction schedule.
Submittal Reviews	● Provide all the material and shop drawing submittals, commented on, and approved by the design team and the Commissioning Authority (CxA).
Pre-Installation Checklists	● Provide the pre-installation checklists as approved by the design team and the Commissioning Authority (CxA).
Installation and Startup checklists	● Provide the installation and startup checklists as approved by the design team and the Commissioning Authority (CxA).
Control Strategy	● Provide the sequence of operation, the interface wiring diagrams, and the BMS schedule of points as approved by the design team and the Commissioning Authority (CxA).
Systems (O&M) Manuals	● Provide the systems' Operation and Maintenance (O&M) manuals as approved by the design team and the Commissioning Authority (CxA).
Operator Training	● Provide the training material.

Training Attendance Sheets	- Consider for each training session attendance sheets, which indicate the date and the scope of the training, and the name, the position, and the signature of each attendee.
Commissioning Test Procedures (CxTPs)	- Perform and verify the Commissioning Test Procedures (CxTPs)
Functional Performance Testing (FPT)	- Provide the Functional Performance Testing (FPT), detailed and in compliance with the commissioning (Cx) specifications.
Commissioning Test Procedures (CxTP) and Functional Performance Testing (FPT) Reports	- Submit Commissioning Test Procedures (CxTP) and Functional Performance Testing (FPT) reports, including Testing, Adjusting, And Balancing (TAB) reports, which are verified against design parameters, and approved by the design team and the Commissioning Authority (CxA).
Issue Reports (Snag List / Punch List)	- Compile all the issue reports, which were issued by both the Commissioning Authority (CxA) and the design team, and indicate the status of each issue at handover.
Trend Log	- Provide the Commissioning Authority (CxA) with the reviewed Trend log for 1 year after handover.
Seasonal and Off-season Testing	- Prepare Commissioning Authority (CxA) approved Test reports for winter operation, summer operation, and off-season operation.
Issue Report Before Warranty Expiry	- Provide the Commissioning Authority (CxA) with the issue report, in which the status of each reported issue is indicated before the warranty expires.
Optimization Reports	- Provide the Commissioning Authority (CxA) with the optimization reports.
Monitoring Reports	- Provide the Commissioning Authority (CxA) with the monitoring reports, and make a commitment to provide these reports every year for the three consecutive post-certification years.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Commissioning Authority (CxA)	- Provide the name and the qualifications of the Commissioning Authority (CxA).
Contract with the Commissioning Authority (CxA)	- Provide the contract with the Commissioning Authority (CxA), which shows the required scope.

Owner's Project Requirements (OPRs)	- Provide the OPRs for the existing building since it also targets the specific issues, which the Facility is struggling with.
Commissioning Team	- Provide the names and the qualifications of the commissioning (Cx)team.
Commissioning Authority (CxA) Observations	Document the collected observation of the Commissioning Authority (CxA): ● At the meeting with the Operations and Maintenance staff ● At the meeting with the occupants ● After walking throughout all the Facility spaces ● Based on the Commissioning Authority (CxA) review of the available maintenance records ● After evaluating the historical energy consumption of the Facility ● After evaluating the historical water consumption of the Facility ● Of the possible achievable system performance given the current system capabilities ● Of the estimated remaining lifetime of the different systems. (Provide copies of the reviewed documents including, but not limited to, O&M manuals, maintenance records, utility bills and records.)
Commissioning Scope and Commissioning Plan	This section shall include ● the commissioning (Cx) scope ● the commissioning (Cx) plan ● the commissioning (Cx) interference with the Facility activities, the potential hazards to the personnel, and other liabilities ● the mitigation of these interferences or hazards.
Individual Component Testing Report	This section shall include ● The summary and the observations of the Commissioning Authority (CxA) based on the review of existing documentation ● The checklist of gathered information versus the missing information ● The component testing interference with the Facility activities, the potential hazards to the personnel, and other liabilities ● The mitigation of these interferences or hazards ● The component test procedures and test reports

	● The summary of the corrective maintenance, which was executed during the testing ● The summary of the required additional corrective maintenance ● The planning, subcontracting, and execution of the additional corrective maintenance ● The retesting and the conclusion.
System Testing Report	This section shall include ● the system Functional Performance Testing (FPT) ● the system testing interference with the Facility activities, the potential hazards to the personnel, and other liabilities ● the mitigation of these interferences or hazards ● the system test reports ● the summary of the corrective maintenance, which was executed during the testing ● The summary of the required additional corrective maintenance.
Training of Operation and Maintenance Staff	● Provide the outlines of each training topic. ● Consider for each training session attendance sheets, which indicate the date and the scope of the training, and the name, position, and signature of each attendee.
Commissioning (Cx) Report	This section shall include ● The executive summary of the process, the findings, and the implemented remedies ● The planning, subcontracting and execution of any additional corrective maintenance ● The retesting reports ● The conclusion vis-à-vis the OPR.
Training the Operations and Maintenance Staff for Operational Sustainability	● Provide the outlines of each training topic. ● Consider for each training session attendance sheets, which indicate the date and the scope of the training, and the name, position, and signature of each attendee.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.4.9.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

For New Building:

Table 7.4.9-2. Factors and Weight factors for each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Commissioning Management for New Building				
Is a Commissioning Authority (CxA) appointed?*	1	Yes / No	1 / 0	
Pre-design Phase				
Are the Owner's Project Requirements, (OPRs) established?	3	Yes / No	1 / 0	1
Are the scope and method of commissioning developed?	4	Yes / No	1 / 0	2
Is the commissioning team selected?	5	Yes / No	1 / 0	3
Is the Basis of Design (BOD) document developed?	6	Yes / No	1 / 0	3
Design Phase		Yes / No	1 / 0	
Is the design review conducted?	7	Yes / No	1 / 0	1
Is the commissioning plan written?	8	Yes / No	1 / 0	1
Are the commissioning specifications written?	9	Yes / No	1 / 0	1
Construction Phase				
Is the commissioning schedule integrated in the construction schedule?	10	Yes / No	1 / 0	1
Is the submittal' review conducted?	11	Yes / No	1 / 0	5
Is the installation verification performed?	12	Yes / No	1 / 0	2
Are start-up acceptance and base-line records performed?	13	Yes / No	1 / 0	2
Are the control strategy and the software reviewed?	14	Yes / No	1 / 0	5

Are systems' (O&M) manuals completed?	15	Yes / No	1 / 0	5
Is an operator training provided?	16	Yes / No	1 / 0	5
Are the Commissioning Test Procedures (CxTP) developed?	17	Yes / No	1 / 0	5
Is Functional Performance Testing (FPT) developed?	18	Yes / No	1 / 0	5
Are tests performed and verified?	19	Yes / No	1 / 0	3
Is issue Reporting (Snag List / Punch List) prepared?	20	Yes / No	1 / 0	5
Post-Handover / Occupancy (1yr after Handover)	21	Yes / No	1 / 0	
Is there Performance Trend-logging?	22	Yes / No	1 / 0	5
Is there off-season Testing?	23	Yes / No	1 / 0	5
Is there end-of-warranty testing?	24	Yes / No	1 / 0	5
Optimization	25	Yes / No	1 / 0	5
Ongoing Monitoring	26	Yes / No	1 / 0	5
Does Commissioning Scope include one or more of the following systems?	27	Yes / No	1 / 0	
Safety Systems	28	Yes / No	1 / 0	5
Energy and Water Systems*	29	Yes / No	1 / 0	5
Generator Emission Validation	30	Yes / No	1 / 0	5
Boiler Emission Validation	31	Yes / No	1 / 0	5
Site Noise Reduction	32	Yes / No	1 / 0	5
Night Light Pollution Reduction	33	Yes / No	1 / 0	5

*Parameters 1 and 29 are pre-requisites for this criterion.

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{11} \quad (F_i * WF_i)}{\sum_{i=1}^{11} \quad WF_i}\right] * F_1 * F_{29}$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

For Existing Building:

Table 7.4.9-3. Factors and Weight factors for each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Retro- Commissioning and Recommissioning Management for Existing Building				
Is a Commissioning Authority appointed?*	1	Yes / No	1 / 0	
Develop the Commissioning Scope and the Commissioning Plan				
Is the Owner's Project Requirements (OPR) established?	2	Yes / No	1 / 0	5
Is the commissioning (Cx) team selected, and are the Operation and Maintenance staff who will be part of the commissioning (Cx) team identified?	3	Yes / No	1 / 0	5
Are the Operations and Maintenance staff met with and are their observations and concerns collected and included in the commissioning (Cx) scope so that a resolution is implemented?	4	Yes / No	1 / 0	5
Are the maintenance records of the Facility reviewed?	5	Yes / No	1 / 0	5
Are the historical energy consumption data evaluated?	6	Yes / No	1 / 0	5
Are the historical water consumption data evaluated?	7	Yes / No	1 / 0	5
Is a walk-through of all spaces conducted?	8	Yes / No	1 / 0	5
Are at least two occupants from each space met with to gather their observations and collect their concerns?	9	Yes / No	1 / 0	5
Is the commissioning occupancy consideration identified along with the	10	Yes / No	1 / 0	3

impact on activities, the level of interference, the potential risks to personnel and material, and the liability issues?				
Is the possible achievable system performance identified given the current system capabilities?	11	Yes / No	1 / 0	3
Is the remaining lifetime of the different systems estimated?	12	Yes / No	1 / 0	3
Is the commissioning scope identified?	13	Yes / No	1 / 0	3
Is the commissioning plan developed?	14	Yes / No	1 / 0	3
Individual Component Testing				
Is the existing documentation collected and reviewed?	15	Yes / No	1 / 0	3
Are both the missing documentation and the missing information sought?	16	Yes / No	1 / 0	3
Is the Facility documentation improved as required?	17	Yes / No	1 / 0	5
Are test procedures established for component testing?	18	Yes / No	1 / 0	3
Are potential risks mitigated during component testing?	19	Yes / No	1 / 0	3
Are occupants informed of any system interruptions?	20	Yes / No	1 / 0	3
Is the component testing conducted?	21	Yes / No	1 / 0	3
Issue the Commissioning (Cx) Report and Recommendations based on Individual Component Testing				
Are the results of component testing reported?	22	Yes / No	1 / 0	3
Is the corrective maintenance, which was done during the testing, documented?	23	Yes / No	1 / 0	3
Is the required corrective maintenance issued as needed?	24	Yes / No	1 / 0	3

Is the possible achievable performance re-evaluated based on the observed systems' capacities?	25	Yes / No	1 / 0	5
Is any additional corrective maintenance such as replacing defective components or duct cleaning etc. scheduled?	26	Yes / No	1 / 0	3
Are potential risks mitigated during the re-testing?	27	Yes / No	1 / 0	3
Are occupants informed of any system interruptions during component re-testing?	28	Yes / No	1 / 0	3
Is corrective maintenance subcontracted whenever required?	29	Yes / No	1 / 0	3
Is component testing concluded after repairs?	30	Yes / No	1 / 0	3
Systems Testing				
Are the systems' Functional Performance Test Procedures (FPTs) established?	31	Yes / No	1 / 0	5
Are the potential risks related to the FPTs mitigated?	32	Yes / No	1 / 0	3
Are occupants informed of any system interruptions during the FPTs?	33	Yes / No	1 / 0	3
Are the FPTs conducted?	34	Yes / No	1 / 0	3
Is the corrective maintenance, which was done during the FPTs, documented?	35	Yes / No	1 / 0	3
Is the required corrective maintenance issued as needed?	36	Yes / No	1 / 0	3
Is the Operation and Maintenance training provided to the Owner's staff?	37	Yes / No	1 / 0	5
Issue Draft Commissioning (Cx) Report				
Are the results discussed with the Owner?	38	Yes / No	1 / 0	3
Subcontract Corrective Maintenance or Modifications if needed				
Are the modifications or the corrective maintenance subcontracted?	39	Yes / No	1 / 0	3

Is there a retest?	40	Yes / No	1 / 0	3
Transfer the Facility to the Operation and Maintenance Staff				
Are the Operation and Maintenance staff provided with the necessary training?	41	Yes / No	1 / 0	5
Are the Owner's operations' staff trained to ensure operational sustainability?	42	Yes / No	1 / 0	5

*Parameter 1 comprises the pre-requisite for this criterion.

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{11} (F_i * WF_i)}{\sum_{i=1}^{11} WF_i}\right] * F_1$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

7.5 Family: Bonus

7.5.1 Si-5.1: Building Information Modeling (BIM)

7.5.1.1 Criterion Reference and Title

Si-5.1: Building Information Modeling (BIM)

7.5.1.2 Criterion Type

Optional

7.5.1.3 Intent

(1)To define the minimum requirements for the use of Building Information Modeling (BIM) in the Project, and (2) to include the generation, revision, visualization, analytical and collaborative use of BIM throughout the project life cycle and delivery, and finally, (3) to advance sustainable designs efficiently.

7.5.1.4 General Requirements

The purpose of this criterion for Building Information Modeling (BIM) requirements is to define the minimum requirements for the use of BIM Level 2 in the project according to the following international standards:

Table 7.5.1-1. BIM Standards

Standards	Title and Description
BS EN ISO 19650-1:2018	Information management using building information modeling – Concepts and principles
BS EN ISO 19650-2:2018	Information management using building information modeling – Delivery phase of the assets
BS EN ISO 19650-3:2020	Information management using building information modeling – Operational phase of assets
BS EN ISO 19650-5:2020	Information management using building information modeling – Security-minded approach to information management
BS 8536-1:2015	Briefing for design and construction Code of practice for facilities management (Building infrastructure)
BS 8536-2:2016	Briefing for design and construction Code of practice for asset management (Linear and geographical infrastructure)
PAS 1192-3:2014	Specifications for information management for the operational phase of assets using Building Information Modeling (BIM)
PAS 1192-5:2015	Specifications for security-minded building information modeling, digital-built environments, and smart-asset management

PAS 1192-6:2018	Specifications for collaborative sharing and use of structured Health and Safety information using BIM
BS 1192-4:2014	Collaborative production of information Part 4: Fulfilling employers' information exchange requirements using COBie.
BS 7000-4:2013	Design management systems – A guide to managing design in construction

BIM deliverables shall include at least the BIM Execution Plan (BEP), a set of project digital representations in the form of 3D BIM Models (Architectural, Structural and MEP), and the other representatives of BIM related to the documentation, design, visualization, analysis, simulation, coordination, and collaboration characteristics throughout the project lifecycle.

Table 7.5.1-2. BIM Uses for different project phase

Project Phase	BIM Uses
Planning	Site Analysis
	Existing Conditions Modeling
	Conceptual and Massing Modeling
	Cost Estimation
Design	Site Modeling
	Design Authoring (Architectural/Structural/MEP)
	3D Model (Architectural/Structural/MEP)
	Design Reviews / Visualization / Rendering
	3D Coordination and Clash Detection
	4D Modeling (Scheduling and Phase Planning)
	5D Modeling (Cost Estimation and Quantity take-off)
	6D Modeling (Sustainability Evaluation as per ARZ)
	Design Drawing Production (Architectural/Structural/MEP)
	Code Validation
	Engineering Analysis: Energy, Lighting, Wind, Fire, HVAC, Acoustic, Structural, etc.)
Construction	Construction Site Planning
	Site Utilization Planning
	3D Model (Architectural/Structural/MEP)
	3D Coordination and Clash Detection
	4D Modeling (Scheduling and Phase Planning)
	5D Modeling (Cost Estimation and Quantity Take-off)
	As-built Drawing Production (Architectural/Structural/MEP)
	Construction System Design

	Record Modeling
	Safety Planning
	Digital Fabrication
	Commissioning Data
Operations	Building Maintenance Scheduling
	Building System Analysis
	Asset Management
	Space Management/ Tracking
	Disaster Planning
	Record Modeling

During the life of the project, the BIM Manager shall engage all participating parties in Building Information Modeling (BIM) in a continuous 3D review process. This procedure may commit BIM to hold meetings with co-coordinators and appropriate decision-making parties from all respective disciplines.

For each phase of the project, a comprehensive BIM plan and model will be developed and will explicitly define the targeted BIM maturity, and Level of Development (LOD) required for the different phases of the project design.

Table 7.5.1-3. Level of Development / Level of Details

Model Name	Project Phase	Level of Development
Architectural Model	Schematic Design	100
	Design Development	200
	Construction	350/400
	Record/Deliverables	350/500
Civil Model	Schematic Design	100
	Design Development	200
	Construction	350
	Record/Deliverables	350/500
Structural Model	Schematic Design	100
	Design Development	200
	Construction	350/400
	Record/Deliverables	350/500
MEP Model	Design Development	200
	Construction	350/400
	Record/Deliverables	350/400/500

Construction/ Record Model(s)	Construction	350/400
	Record/Deliverables	500

During the initial design phase, the BIM manager and the project team shall develop the Building Execution Plan (BEP) with the Client’s and Stakeholders’ input to provide the basis for ongoing coordination throughout the BIM process. It describes how BIM is utilized at the beginning of the design phase producing coordinated drawings for agency approval and bidding, and through the whole construction process of the project.

The Building Execution Plan (BEP) will serve as the foundation for identifying the minimal requirements which must be met including, but not limited to

Table 7.5.1-4. Building Execution Plan (BEP) Outline

Building Execution Plan (BEP) Outline		
1	**Introduction**	● Introduce the scope, the project team, and any related information.
2	**General Requirements**	● Specify the project requirements outside of the BIM scope. ● Provide reference to the minimal standards of BIM guidelines.
3	**Goals of the BIM Process**	● Show the BIM process, which addresses the objectives needed by the BIM guideline. Specify further the BIM objectives and procedures, which are not covered in the BIM guideline. ● Describe how the project team will provide BIM deliverables, which satisfy the project requirements.
4	**Technology Applications**	● Software (Design, clash coordination, design visualization, submittal, project management, etc.) ● Project information accessibility (Cloud-based tools) ● Mobile applications (Software, tools, applications, etc.) ● File-Sharing Platform (Model Exchange and Conversion) ● Document Management Process ● Training Plan
5	**BIM Team and Contacts**	● Identify the BIM Team and their contact information.
6	**Project Collaboration Solution**	● Define the Meeting Space and how it will be utilized to achieve the desired objective.

7	**Model Organization Model Segregation and File Naming**	● Identify models and owners as well as file naming conventions, authoring tools, conversion file versioning (e.g., IFC exports), file location, and file exchange frequency. Include partitioning, naming, and versioning of files.
8	**Project Schedule and Milestone Submissions**	● Assign project and collaboration meeting schedules, requirements, and team/owner deliverable schedules.
9	**Common Coordinate System and Units**	● Identify project units and global coordinate system.
10	**Modeling Techniques**	● Identify best modeling practices for each discipline. ● Identify organization's standard practice. ● Address potential problems with solutions. ● Identify the approaches, which will create a consistent model to be intergraded into life cycle management software.
11	**Model Level of Development Matrix**	● Fill the Level of Development (LOD) matrix as per BIM standard. ● Create a plan, and describe the procedures through which the project team will adhere to the requirements of each phase.
12	**BIM Deliverables and Responsibility Matrix**	● Use the BIM Matrix as baseline in the BIM standard. ● Define the ownership and improvements of the elements. Fill out this matrix as a team. Create a plan, and describe the procedures through which the project team will adhere to the requirements for each phase.
13	**3D Modeling Process and Schedule**	● Provide details.
14	**Coordination/Clash Detection Process and Schedule**	● Include information about clash sets and hierarchy, color coordination, model setup for export views, and the scheduling and location of recurring meetings.
15	**BIM Scheduling and Sequencing**	● Provide details.
16	**Submittal Tracking**	● Provide information on how to reduce the number of Requests for Information (RFI). At the start of the project, establish a submission tracking environment, to which team members will be invited.

17	**Model Validation and Quality Assurance**	● Provide details.
18	**Record Model Submission**	● Specify the requirements of the deliverables as per the contract. Provide instructions on how to accomplish the deliverables most effectively.
19	**Additional Processes and Protocols**	● Provide details.

In addition to the BIM Execution Plan (BEP), it is recommended to prepare the documents hereunder:

- Asset Information Requirements (AIR)
- Project Information Requirements (PIR)
- Exchange Information Requirements (EIR)
- Organizational Information Requirements (OIR)
- Project Information Protocol (PIP)
- Common Data Environment (CDE)
- Master Information Delivery Plan (MIDP)
- Model Production Delivery Table (MPDT).

7.5.1.5 Special Requirements

None

7.5.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.5.1-5. Required submittals

Submittal Name	**Submittal Description**
New Building in Design Phase	
BIM Deliverables	● BIM Deliverables but not limited to: ○ Prerequisite Deliverables: The BIM Execution Plan (BEP) shall be prepared to detail how BIM will be used during the project life cycle. ○ Optional Deliverables: Asset Information Requirements (AIR), Project Information Requirements (PIR), Exchange Information Requirements (EIR), Organizational Information Requirements (OIR), Project Information

	Protocol (PIP), Common Data Environment (CDE), Master Information Delivery Plan (MIDP), Model Production Delivery Table (MPDT)
BIM Uses	● BIM Uses, but not limited to: ○ Prerequisite BIM Uses: Site modeling, Design Authoring, Design Drawings Production, Design Reviews / Visualization / Rendering, 3D Models, 3D Coordination and Clash Detection ○ Optional BIM Uses: 4D, 5D and 6D BIM Modeling, Code Validation, Model Analysis (Structural, Lighting, Daylighting, Energy, HVAC, Thermal, Wind, Fire and Acoustic)
New Building in Construction Phase	
BIM Uses	● BIM Uses, but not be limited to: ○ **Prerequisite BIM Uses**: Construction Site Planning, Site Utilization Planning, As-built Drawings Production, 3D As-built Models, 3D Coordination, and Clash Detection ○ **Optional BIM Uses:** 4D and 5D BIM Modeling, Construction System Design, Record Modeling, Safety Planning, Digital Fabrication, Commissioning Data
Existing Building	
BIM Uses	● BIM Uses, but not limited to: ○ **Prerequisite BIM Uses**: Building Maintenance Scheduling, Space Management / Tracking, Building System Analysis ○ **Optional BIM Uses:** Asset Management, Disaster Planning, Record Modeling

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents which can provide additional relevant information for the certification reviewers to consider.

7.5.1.7 Score Allocation

The score for this criterion is determined based on the following score allocation table for each project phase, and for each criterion requirement.

For New Building in Design Phase

Table 7.5.1-6. Factors and Weight Factors for each criterion requirement of design phase

Criterion Requirement			Status	Factor		Weight Factor "WF"	
Planning Phase BIM Uses	1	Site Analysis	Yes	F_1	1	WF_1	1
			No		0		
	2	Existing Conditions Modeling	Yes	F_2	1	WF_2	1
			No		0		
	3	Conceptual and Massing Modeling	Yes	F_3	1	WF_3	1
			No		0		
	4	Cost Estimation	Yes	F_4	1	WF_4	1
			No		0		
Design Phase – BIM Uses	5	Site Modeling *	Yes	F_5	1	WF_5	5
			No		0		
	6	Design Authoring (Architectural/Structural/MEP) *	Yes	F_6	1	WF_6	6
			No		0		
	7	Design Drawing Production (Architectural/Structural/MEP) *	Yes	F_7	1	WF_7	3
			No		0		
	8	Design Reviews / Visualization / Rendering *	Yes	F_8	1	WF_8	8
			No		0		
	9	3D Coordination and Clash Detection *	Yes	F_9	1	WF_9	6
			No		0		
	10	3D Model (Architectural/Structural/MEP) *	Yes	F_{10}	1	WF_{10}	10
			No		0		
Design Phase – BIM Uses	11	4D Modeling (Scheduling & Phase Planning)	Yes	F_{11}	1	WF_{11}	6
			No		0		
	12	5D Modeling (Cost Estimation & Quantity take-off)	Yes	F_{12}	1	WF_{12}	6
			No		0		
	13	6D Modeling (Sustainability Evaluation as per ARZ)	Yes	F_{13}	1	WF_{13}	6
			No		0		
	14	Code Validation	Yes	F_{14}	1	WF_{14}	1
			No		0		
	15	Structural Analysis	Yes	F_{15}	1	WF_{15}	3
			No		0		
	16	Lighting Analysis	Yes	F_{16}	1	WF_1	3
			No		0		
	17	Daylighting Analysis	Yes	F_{17}	1	WF_{17}	3
			No		0		
	18	Energy Analysis	Yes	F_{18}	1	WF_{18}	4
			No		0		
	19	HVAC Analysis	Yes	F_{19}	1	WF_{19}	3
			No		0		
	20	Thermal Analysis	Yes	F_{20}	1	WF_{20}	3

			No		0		
	21	Wind Analysis	Yes	F_{21}	1	WF_{21}	3
			No		0		
	22	Fire Analysis	Yes	F_{22}	1	WF_{22}	3
			No		0		
	23	Acoustic Analysis	Yes	F_{23}	1	WF_{23}	3
			No		0		
BIM Deliverables	1	BIM Execution Plan (BEP) *	Yes	F_{24}	1	WF_{24}	10
			No		0		
	2	Asset Information Requirements (AIR)	Yes	F_{25}	1	WF_{25}	5
			No		0		
	3	Project Information Requirements (PIR)	Yes	F_{26}	1	WF_{26}	5
			No		0		
	4	Exchange Information Requirements (EIR)	Yes	F_{27}	1	WF_{27}	5
			No		0		
	5	Organizational Information Requirements (OIR)	Yes	F_{28}	1	WF_{28}	5
			No		0		
	6	Project Information Protocol (PIP)	Yes	F_{29}	1	WF_{29}	5
			No		0		
	7	Common Data Environment (CDE)	Yes	F_{30}	1	WF_{30}	5
			No		0		
	8	Master Information Delivery Plan (MIDP)	Yes	F_{31}	1	WF_{31}	5
			No		0		
	9	Model Production Delivery Table (MPDT)	Yes	F_{32}	1	WF_{32}	5
			No		0		
*** Minimum Required (Prerequisite)**							

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \prod_{i=5}^{10} F_i * F_{24} * \left[\frac{(\sum_{i=1}^{32} \quad F_i * WF_i)}{(\sum_{i=1}^{32} \quad WF_i)} \right]$$

Should no prerequisite BIM uses or deliverables or criterion requirements be performed, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned criterion requirements are satisfied in the project.

For New Building in Construction Phase

Table 7.5.1-7. Factors and Weight Factors for each criterion requirement of construction phase

Criterion Requirement			Status	Factor "F"		Weight Factor "WF"	
Construction Phase – BIM Uses	1	Construction Site Planning *	Yes	$\boldsymbol{F_1}$	1	$\boldsymbol{WF_1}$	5
			No		0		
	2	Site Utilization Planning *	Yes	$\boldsymbol{F_2}$	1	$\boldsymbol{WF_2}$	5
			No		0		
	3	As-built Drawing Production (Architectural/Structural/MEP) *	Yes	$\boldsymbol{F_3}$	1	$\boldsymbol{WF_3}$	3
			No		0		
	4	3D As-built Model (Architectural/Structural/MEP) *	Yes	$\boldsymbol{F_4}$	1	$\boldsymbol{WF_4}$	8
			No		0		
	5	3D Coordination and Clash Detection *	Yes	$\boldsymbol{F_5}$	1	$\boldsymbol{WF_5}$	6
			No		0		
	6	4D Modeling (Scheduling & Phase Planning)	Yes	$\boldsymbol{F_6}$	1	$\boldsymbol{WF_6}$	5
			No		0		
	7	5D Modeling (Cost Estimation & Quantity take-off)	Yes	$\boldsymbol{F_7}$	1	$\boldsymbol{WF_7}$	5
			No		0		
	8	Construction System Design	Yes	$\boldsymbol{F_8}$	1	$\boldsymbol{WF_8}$	2
			No		0		
	9	Record Modeling	Yes	$\boldsymbol{F_9}$	1	$\boldsymbol{WF_9}$	2
			No		0		
	10	Safety Planning	Yes	$\boldsymbol{F_{10}}$	1	$\boldsymbol{WF_{10}}$	2
			No		0		
	11	Digital Fabrication	Yes	$\boldsymbol{F_{11}}$	1	$\boldsymbol{WF_{11}}$	3
			No		0		
	12	Commissioning Data	Yes	$\boldsymbol{F_{12}}$	1	$\boldsymbol{WF_{12}}$	3
			No		0		
*** Minimum Required (Prerequisite)**							

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \prod_{i=1}^{5} F_i * \left[\frac{(\sum_{i=1}^{12} F_i * WF_i)}{(\sum_{i=1}^{12} WF_i)}\right]$$

Should no prerequisite BIM uses or criterion requirements be performed, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned criterion requirements are satisfied in the project.

For Existing Building

Table 7.5.1-8. Factors and Weight Factors for each criterion requirement of existing building

Criterion Requirement			Status	Factor "F"		Weight Factor "WF"	
Existing Building – BIM Uses	1	Building Maintenance Scheduling *	Yes	$\boldsymbol{F_1}$	1	$\boldsymbol{WF_1}$	6
			No		0		
	2	Space Management / Tracking *	Yes	$\boldsymbol{F_2}$	1	$\boldsymbol{WF_2}$	5
			No		0		
	3	Building System Analysis *	Yes	$\boldsymbol{F_3}$	1	$\boldsymbol{WF_3}$	4
			No		0		
	4	Asset Management	Yes	$\boldsymbol{F_4}$	1	$\boldsymbol{WF_4}$	4
			No		0		
	5	Disaster Planning	Yes	$\boldsymbol{F_5}$	1	$\boldsymbol{WF_5}$	3
			No		0		
	6	Record Modeling	Yes	$\boldsymbol{F_6}$	1	$\boldsymbol{WF_6}$	3
			No		0		
*** Minimum Required (Prerequisite)**							

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 \ * \prod_{i=1}^{3} F_i * \left[\frac{\left(\sum_{i=1}^{6} F_i * WF_i\right)}{\left(\sum_{i=1}^{6} WF_i\right)}\right]$$

Should no prerequisite BIM uses or criterion requirements be performed, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned criterion requirements are satisfied in the project.

7.5.2 Si-5.2: Integrated Building Design

7.5.2.1 Criterion Reference and Title

Si-5.2: Integrated Building Design

7.5.2.2 Criterion Type

Optional

7.5.2.3 Intent

To support an integrative building design, which integrates people, systems, business structures and practices into one whole process throughout all the phases of the project lifecycle. To produce a higher-performance building, which achieves maximum energy and water efficiency, a better indoor environment, more comfort, less waste, and less operating and maintenance costs.

7.5.2.4 General Requirements

Develop an integrative building design throughout all the phases of the project lifecycle. For this end, the project team shall achieve:

- Energy consumption reduction
- Water use and waste water production reduction
- Operation and maintenance costs reduction
- Waste production reduction
- An improved comfort level, a higher productivity, and a healthier environment for occupants
- Greater marketability.

The integrated building design must be documented in the required submittal documents hereunder:

- The Criterion Narrative
- The Life Cycle Analysis.

Integrated Team

An integrative building design process shall provide a framework for collective visioning and goal setting. The continued engagement of a broad spectrum of project stakeholders plays a key role in creating a collaborative team who thrives to construct higher-performance buildings from the early planning and design stages.

The collaborative team should consist, at a minimum, of the following stakeholders: the owner, the end users, the architect, the engineers, the contractors, the builders, the suppliers, the specialists, and the consultants in various fields. The broad spectrum of team members stimulates discussions, enhances brainstorming, and encourages team members to achieve the desired goals through close collaboration all throughout the phases of the project lifecycle. As a team, while their first goal is to optimize the design, the value, and the efficiency, their second is definitely to reduce waste.

Designers are encouraged to be more innovative and expressive with their ideas and solutions, which makes integrated building design projects more interesting to work on. The presence of the construction team during the design phase holds substantial benefits: It enables the foresight and resolution of any design-related problems, a better pre-construction plan, enhanced quality, and cost management. When decisions are made early in the design phase, modifications will still be possible and will be more cost -effective than when they are made at a later stage in the building process. As a project develops, the cost to make changes to the design and the material choices increases.

The success of the project is linked to the success of the team as a whole by building on the early contributions of important project stakeholders. Meetings and workshops must be planned and handled properly and efficiently in order to save money and time. When planning and organizing a meeting/workshop, the following items should be considered at the very least: planning, reviewing, group activities, brainstorming, focusing, questioning, recording.

To have an Integrated Team achieve this credit, key stakeholders are required. The table hereunder shows a classification of the required key stakeholders .

Table 7.5.2-1. Key Stakeholders Required for Integrated Team

key Stakeholders Required for Integrated Team			
Building Owners	**Design Professionals**	**Consultants**	**Construction**
Owner End Users	Architect Civil Engineer	Sustainability Expert	General Contractor

	Mechanical Engineer Electrical Engineer		

The potential additional stakeholders for the Integrated Team can be classified as follows in the table hereunder. Additional points will be granted according to the additional stakeholders group.

Table 7.5.2-2. Potential Stakeholders Required for Integrated Team

Potential Stakeholders for Integrated Team				
Building Owners	**Design Professionals**	**Consultants**	**Construction & Operation**	**Authorities & Agencies**
Owner Client Management Agent Financier End Users	Project Manager Architect Landscape Architect Interior Designer Civil Engineer Mech. Engineer Elec. Engineer	Sustainability Expert Ecologist Cx Agent BIM Manager Energy Specialist BMS Specialist Controls Specialist Lighting Specialist Acoustic Specialist Fire Specialist CFD Expert	General Contractor Sub-Contractors Facility Manager Building Operator Material Expert Suppliers	Regulatory Authorities Government Agencies, Planners, Code Officials

Integrated System

An integrated system is a system of buildings which consists of multiple-coordinated components to fulfill a clearly defined performance requirement. Combinations of devices, assemblies, material configurations, controls, and other electrical, mechanical, and structural strategies may be used to achieve a particular objective. Building systems, materials, and products must be integrated to create a unified whole, which fulfills the intended functional purpose. In a well-designed project, building systems also contribute (1) to make the building more energy-efficient, (2) to reduce costs, (3) to improve the functionality of the building, and (4) to collect data and put them to task.

An Integrated Building System could cover the following systems in the building:

Table 7.5.2-3. Building Systems

Building Systems			
Architectural	**Civil / Structural**	**Electrical**	**Mechanical**
Architectural Systems Building Envelope Massing and Orientation Thermal Comfort Passive Design System	Structural frame System Storing System Storm water System Infrastructure System	Lighting/Power System Low Current System Fire Alarm System BMS system Renewable Energy Energy storage	HVAC System Drainage System Water System Irrigation System Fire/Smoke System Gas System

Integrated Process

The integrated building design process does not only incorporate collaborative methods, tools, technologies, and activities, but also integrates management, modeling, and simulation. Besides encouraging building lifecycle management, the integrated building design process provides the best opportunity to accomplish aggressive environmental and sustainability objectives when energy and carbon reduction in complex systems are the target.

The Integrated Process can cover the following: Building Information Modeling (BIM), Virtual Reality (VR), Augmented Reality (AR), Machine Learning (ML), Artificial Intelligence (AI), Internet of Things (IOT), Modeling and Simulation software (Energy Analysis, CFD Analysis), Project Management, Data Management (Data Analysis, Data Storing, Data Mining), etc.

Life Cycle Cost (LCC)

A Life Cycle Cost (LCC) analysis and report shall be prepared for two reasons:(1) to estimate the total costs of the project alternatives, and (2) to select the design, which ensures that the Facility has the lowest total cost of ownership. The whole is consistent with its quality and function and takes into account all the costs associated with the acquisition, ownership, and disposal of a building or building system. The Life Cycle Cost Analysis (LCCA) should be conducted early in the design phase, when there is still time to improve the design and guarantee cost savings throughout the life of the project (LCC). Net Benefits, Savings Benefit-to-Cost Ratio, Internal Rate of Return, and Payback Period are all frequently used economic assessment metrics. As techniques, they are advantageous to determine the economic consequences of various buildings and building system designs, and to quantify and express these consequences in monetary terms.

7.5.2.5 Special Requirements

None

7.5.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.5.2-4. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion. It must cover at a minimum the following: ○ The stakeholders' list and the project team's list, CVs, roles, and responsibilities ○ The sustainability vision, mission, objectives, and targets ○ The minutes of meetings and workshops ○ The methodologies and the process charts ○ The implementation strategies ○ The description of the integrated systems ○ The integrated process types (tools, methods, technologies, modeling, simulation, management, etc.).
Life Cycle Cost Analysis	● A Life Cycle Cost (LCC) analysis and report shall be prepared (1) to estimate the total costs of the project and (2) to identify the design, which achieves the lowest overall costs of ownership while still meeting the quality and function requirements.
● New Building in Construction Phase	
Criterion Narrative	● The updated Criterion Narrative (if different from the Design phase)
Life Cycle Cost Analysis	● The updated Life Cycle Cost (LCC) analysis and report which reflects the final construction cost should be provided.
● Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion. It must cover at a minimum the following:

	○ The stakeholders’ list and the project team’s list, CVs, roles, and responsibilities ○ The sustainability vision, mission, objectives, and targets ○ The minutes of meetings and workshops ○ The methodologies and the process charts ○ The implementation strategies ○ The description of the integrated systems ○ The integrated process types (tools, methods, technologies, modeling, simulation, management, etc.).
Life Cycle Cost Analysis	● A Life Cycle Cost (LCC) analysis and report shall be prepared (1) to estimate the total costs of the project and (2) to identify the design, which achieves the lowest overall costs of ownership while still meeting the quality and function requirements.

7.5.2.7 Score Allocation

The score for this criterion is determined based on the following score allocation table for each project phase, and for each criterion requirement.

Table 7.5.2-5. Factors and Weight Factors for Each Criterion Requirement

Criterion Requirement			**Status**	**Factor “F”**		**Weight Factor “WF”**	
Integrated Team (Required and Potential Stakeholders)	1	Owner/ Client/ Agent/ Management/ Financier/ End Users *	Yes	F_1	1	WF_1	10
			No		0		
	2	Sustainability Expert *	Yes	F_2	1	WF_2	12
			No		0		
	3	Architect *	Yes	F_3	1	WF_3	10
			No		0		
	4	Civil Engineer *	Yes	F_4	1	WF_4	10
			No		0		
	5	Mechanical Engineer *	Yes	F_5	1	WF_5	10
			No		0		
	6	Electrical Engineer *	Yes	F_6	1	WF_6	10
			No		0		
	7	General Contractor *	Yes	F_7	1	WF_7	3
			No		0		
	8	BIM Manager	Yes	F_8	1	WF_8	6
			No		0		
	9	Commissioning (Cx) Agent	Yes	F_9	1	WF_9	6
			No		0		
	10	Energy Specialist	Yes	F_{10}	1	WF_{10}	6

			No		0		
	11	CFD Expert	Yes	F_{11}	1	WF_{11}	4
			No		0		
	12	BMS Specialist	Yes	F_{12}	1	WF_{12}	4
			No		0		
	13	Facility Manager	Yes	F_{13}	1	WF_{13}	4
			No		0		
	14	Landscape Architect	Yes	F_{14}	1	WF_{14}	3
			No		0		
	15	Ecologist	Yes	F_{15}	1	WF_{15}	3
			No		0		
	16	Control Specialist	Yes	F_{16}	1	WF_{16}	2
			No		0		
	17	Lighting Specialist	Yes	F_{17}	1	WF_{17}	2
			No		0		
	18	Acoustic Specialist	Yes	F_{18}	1	WF_{18}	2
			No		0		
	19	Fire Specialist	Yes	F_{19}	1	WF_{19}	2
			No		0		
	20	Interior Design	Yes	F_{20}	1	WF_{20}	1
			No		0		
	21	Sub-contractors	Yes	F_{21}	1	WF_{21}	1
			No		0		
	22	Materials Expert	Yes	F_{22}	1	WF_{22}	1
			No		0		
	23	Suppliers	Yes	F_{23}	1	WF_{23}	1
			No		0		
	24	Acoustic Analysis	Yes	F_{24}	1	WF_{24}	1
			No		0		
	25	Regulatory Authorities	Yes	F_{25}	1	WF_{25}	1
			No		0		
	26	Government Agencies	Yes	F_{26}	1	WF_{26}	1
			No		0		
	27	Planners, Code Officials	Yes	F_{27}	1	WF_{27}	1
			No		0		
Integrated Design	1	Criterion Narrative*	Yes	F_{28}	1	WF_{28}	16
			No		0		
	2	Life Cycle Cost (LCC) Analysis & Report	Yes	F_{29}	1	WF_{29}	20
			No		0		
*** Minimum Required (Prerequisite)**							

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \prod_{i=1}^{7} F_i * F_{28} * \left[\frac{(\sum_{i=1}^{29} F_i * WF_i)}{(\sum_{i=1}^{29} WF_i)}\right]$$

The score for this criterion will be 0% if (1) no prerequisite integrated team member is present in the project, (2) the brief narrative did not submit the deliverables, or (3) all the criterion requirements are not performed. A project earns a score of 100% for this criterion if all the aforementioned criterion requirements are performed in the project.

7.5.3 Si-5.3: Preserve Local Heritage and Cultural Identity

7.5.3.1 Criterion Reference and Title

Si-5.3: Preserve Local Heritage and Cultural Identity

7.5.3.2 Criterion Type

Optional

7.5.3.3 Intent

To encourage design strategies, which reflect local heritage and preserve the cultural identity.

7.5.3.4 General Requirements

Design the building in a manner to incorporate architectural design features and/or technical solutions, which are inspired by the local heritage. These architectural design features and/or technical solutions should (1) showcase the cultural identity, (2) demonstrate passive design approaches, and (3) contribute to energy efficiency, water conservation or improved indoor/outdoor comfort.

The design team should implement strategies to ensure that the project preserves the local heritage and enhances cultural identity.

The design team should

- Conduct research about the history of the region, and consult with local experts for further recommendations and guidance on the proposed building's design in relation to local heritage and cultural identity.
- Identify cultural and traditional elements, which can be incorporated within the building design. The cultural identity can be reflected in the building's form and overall aesthetics, the building layout and space uses, and the selection of materials (consider using regionally available building materials to promote consistent aesthetics and achieve harmonization with the existing building fabric).
- Ensure that the proposed building design is well-incorporated into the surrounding neighborhood, and will not degrade the cultural character of any existing surrounding buildings.

The following are examples of design features inherent in typical traditional Lebanese constructions:

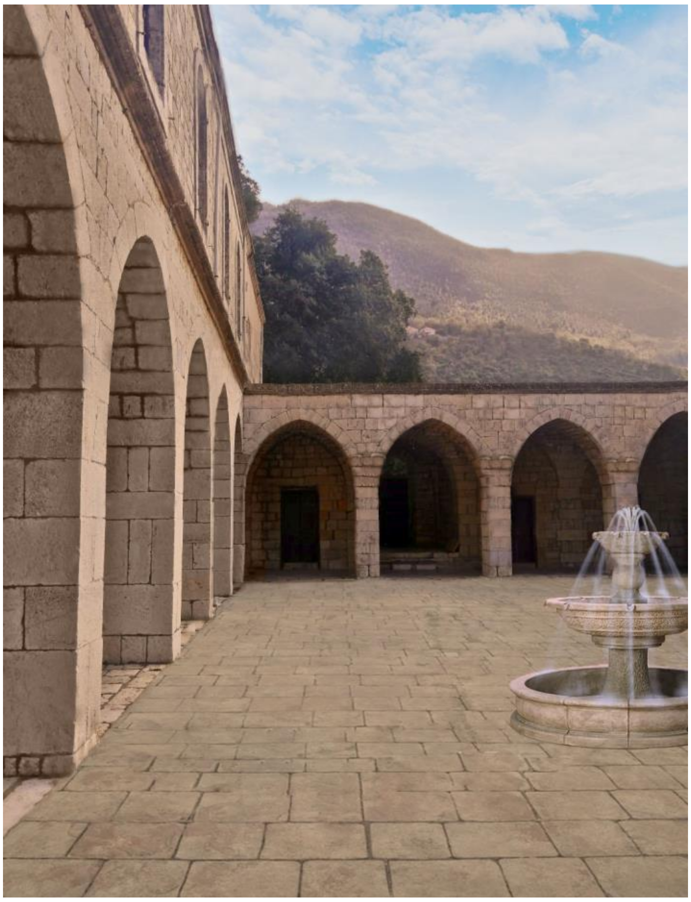
- Traditional red-tiled roofs reduce heat gain through roofs.

- Locally-sourced natural stone cladding for exterior walls increases envelope thermal mass and insulation.

- External wood window shutters reduce solar heat gain coming in through windows.

- Traditional arch design for windows and doors increases indoor natural daylight.

- Interior courtyards allow more natural daylight and more ventilation in, and provide a recreation area.



Design features, which are inspired by local heritage, should be implemented.

7.5.3.5 Special Requirements

None

7.5.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 7.5.3-1. Required submittals

Submittal Name	**Submittal Description**
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Local Heritage and Cultural Identity Report	● Build a research report including design features, which reflect local heritage and cultural identity. ● Describe the benefits of each design feature in relation to energy or water savings, indoor/outdoor environment improvements, emission reductions, etc.
Design Drawings	● Include Design Drawings showing incorporated design features. ● Use 3D visualizations of the building showing the design elements.
New Building in Construction Phase	
Criterion narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Local Heritage and Cultural Identity Report	● Build a research report including design features, which reflect local heritage and cultural identity. ● Describe the benefits of each design feature in relation to energy or water savings, indoor/outdoor environment improvements, emission reductions, etc.
As-built Drawings	● Provide As-built Drawings showing incorporated design features, which reflect local heritage and cultural identity. ● Include photos of the building showing the installed features.
Existing Building	

Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Local Heritage and Cultural Identity Report	● Build a research report including design features, which reflect local heritage and cultural identity. ● Describe the benefits of each design feature in relation to energy or water savings, indoor/outdoor environment improvements, emission reductions, etc.
As-built Drawings	● Provide As-built Drawings showing incorporated design features, which reflect local heritage and cultural identity. ● Include photos of the building showing the installed features.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.5.3.7 Score Allocation

The score for this criterion is determined based on the number of implemented design features, which are inspired by the local heritage. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{Number\ of\ implemented\ design\ features}{Total\ number\ of\ available\ design\ features\ identified\ in\ research}$$

7.5.4 Si-5.4: Innovation

7.5.4.1 Criterion Reference and Title

Si-5.4: Innovation

7.5.4.2 Criterion Type

Optional

7.5.4.3 Intent

To support innovation and new solutions for the smart site and the planning of the project through technologies, systems, or processes, which are not rewarded by standard ARZ criteria.

7.5.4.4 General Requirements

Demonstrate that any of the following can be proven effective in terms of sustainability analysis for Site and Planning, and which is not covered in ARZ 2.0, such as any new smart solution, technology, invention, design, construction, operation, maintenance or demolition method or process. The innovation must be approved by LGBC as an integral part of the submitted application form during the official rating. The innovation must be significant, achievable, and measurable by identifying the following:

- The intent of the proposed innovation criterion
- The proposed general and special requirements for compliance
- The proposed required submittals to demonstrate compliance.

Up to a maximum of 5 innovation items are available in aggregate from a combination of the following:

1) Approved Innovation

One innovation criterion can be awarded for each innovation application form approved by LGBC after the submittal for the review process.

2) Exemplary Level of Performance According to ARZ Criteria in the Site Module

The project demonstrates exemplary performance if one or more of the following ARZ assessment criteria are met at an exemplary level of performance:

- Si-1.3 Preservation or Enhancement of Ecological Value

- Si-2.1 Outdoor Areas for Recreation
- Si-2.2 Bicycle Racks
- Si-2.3 Sustainable Parking Management Program
- Si-4.7 Emissions Measurements
- Si-4.8 Pollution Prevention of Maintenance Activities

7.5.4.5 Special Requirements

None

7.5.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 7.5.4-1. Required submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	● Submit the drawings of the proposed innovation or exemplary performance (if available)
Specifications	● Submit an extract of the specifications of the proposed innovation or exemplary performance (if available)
New Building in Construction Phase	
Criterion Narrative	● The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	● Submit the As-built Drawings of the proposed innovation or exemplary performance (if available).
Manufacturer Datasheets	● Submit the Manufacturer Datasheets of the proposed innovation or exemplary performance (if available).
Guideline	● Provide a documentation guideline how the proposed innovation materializes.
Existing Building	
Criterion Narrative	● The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	● Submit the As-built Drawings of the proposed innovation or exemplary performance (if available).

Manufacturer Datasheets	- Submit the Manufacturer Datasheets / Catalogs of the proposed innovation or exemplary performance (if available).
Guideline	- Provide a documentation guideline how the proposed innovation materializes.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

7.5.4.7 Score Allocation

The score for the innovation criterion is determined based on the innovation or exemplary performance achieved. The weight factor will be set once the ARZ review committee members assess the originality and performance of the submitted innovation.

Table 7.5.4-2. Weight Factor for Each Criterion Requirement

Parameters Requirements	**Weight Factor "WF"**	
Innovation Feature-1	WF_1	58
Innovation Feature-2	WF_2	10
Innovation Feature-3	WF_3	10
Innovation Feature-4	WF_4	10
Innovation Feature-5	WF_5	10

The calculator will determine a preliminary score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{5} (F_i * WF_i)}{\sum_{i=1}^{5} WF_i}\right]$$

Where:

F_i is calculated using the following formula:

If project includes innovation Features, F_i=1

If project does not include innovation features, F_i=0

8. Module: Materials

8.1 Family: Waste Management

8.1.1 Ma-1.1: Solid Waste management – During Construction

8.1.1.1 Criterion Reference and Title

Ma-1.1: Solid Waste Management - During Construction

8.1.1.2 Criterion Type

Optional

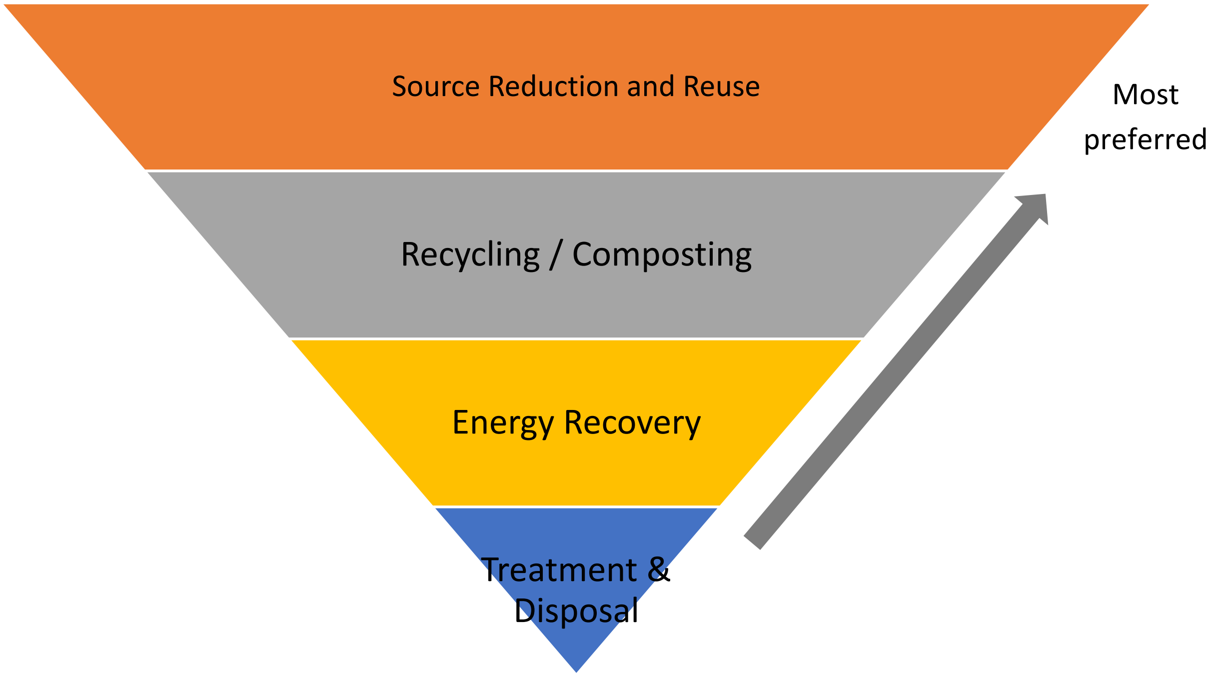
8.1.1.3 Intent

To reduce the waste materials generated from construction activities and associated environmental impacts by developing and implementing a construction waste management plan.

8.1.1.4 General Requirements

Construction waste management considers a hierarchical system where source reduction is the preferred solution, and waste recovery is the last option before disposal.

Waste Management Hierarchy



Source Reduction and Reuse

Source control, which is the most effective strategy for waste reduction, is based on implementing techniques to avoid and minimize On-site waste generation. Source reduction includes the following techniques:

- Ordering prefabricated or cut-to-size materials in order to minimize On-site fabrication waste
- Ordering materials with the least packaging amount possible
- Ensuring proper storage and handling of materials to avoid damage
- Encouraging the use of electronic media, such as virtual communication, meetings, and presentations instead of paper-based ones
- Reusing materials found On-site. For example, repurposing crushed concrete waste On-site and using it as filling material where possible.

Recycling / Composting

Recycling or Composting is the next preferred strategy for construction waste management. On-site collection and storage of waste materials must be implemented, and can be achievable through the following measures:

- Providing separate waste collection bins/skips for each material stream in order to ensure proper waste segregation. Examples of material streams include
  - Specific material type, which is sent to specialized recycling facilities (i.e., metals, paper/cardboard, masonry, concrete, plastics, wood, food waste, etc.)
  - Mixed-waste type, which is sent to Off-site sorting and recycling facilities
  - Materials, which are suitable for reuse on other sites.
- Labeling waste bins/skips clearly to avoid cross-contamination
- Distributing the waste bins/skips in work areas at the point of generation, and/or installing them in the central waste storage yard
- Training all working staff on proper On-site sorting of construction waste.

Energy Recovery

Energy recovery from waste is the process of generating energy in the form of electricity and/or heat from the primary treatment of waste, or the processing of waste into a fuel source. This process is often called waste-to-energy.

Energy recovery or waste-to-energy should be considered as a diversion strategy for non-recyclable waste materials before landfilling.

Treatment and Disposal

The last option in waste management is the treatment and disposal of materials in landfills. This option should only be considered if reuse, recycling or recovery options are not feasible.

Hazardous waste should be stored in dedicated areas/containers and sent to specialized facilities for proper treatment and disposal.

The project should divert at least 10% of the generated waste during construction (either by weight or by volume) in order to comply with the minimum requirements for this criterion. The score for this criterion is determined based on the achieved diversion rate and the number of waste material streams.

8.1.1.5 Special Requirements

None

8.1.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.1.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Project specifications	• The Project Specifications should (1) include the requirement to develop and implement a waste management plan during construction, and (2) specify the required diversion rate and number of waste streams.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Construction Waste Management Plan	• The Construction Waste Management Plan should include the proposed strategies, which will be implemented in waste management during the construction phase.
Waste receipts	• The waste receipts should include the weight/volume of all the generated waste streams. As for all the diverted waste streams, the receipts should include the diversion strategy and the name of the facility.
Existing Building	
• N/A	•

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.1.1.7 Score Allocation

Weight factors are applied to each requirement as follows:

Criterion Requirements	Weight Factor (WF)	
Waste Diversion Rate (either by weight or volume)	1. WF_1	2. 2
Number of Waste Material Streams	3. WF_2	4. 1

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_3 * \frac{WF_1 \ * \ F_1 + WF_2 \ * \ F_2}{WF_1 + WF_2}$$

Where:

- F_1 is determined as follows:
  If the Waste Diversion Rate ≥ 90%, $F_1 = 1$
  If the Waste Diversion Rate < 10%, $F_1 = 0$
  If the Waste Diversion Rate is between 10% and 90%, $F_1 = \frac{Waste\ Diversion\ Rate}{0.9}$
- F_2 is determined as follows:
  If the Number of Material Streams ≥ 3, $F_2 = 1$
  If the Number of Material Streams < 3, $F_2 = \frac{Number\ of\ Material\ Streams}{3}$
- F_3 is determined as follows:
  If the Construction Waste Management Plan is provided, $F_3 = 1$
  If the Construction Waste Management Plan is not provided, $F_3 = 0$

A project earns a score of 100% if a construction waste management plan is provided, and a waste diversion rate of at least 90% is achieved through at least 3 material streams.

8.2 Family: Materials' Sourcing

8.2.1 Ma-2.1: Local/Regional Materials

8.2.1.1 Criterion Reference and Title

Ma-2.1: Local/Regional Materials

8.2.1.2 Criterion Type

Optional

8.2.1.3 Intent

To encourage the selection of building materials and products, which are locally extracted and manufactured, thereby supporting local economy, and reducing the environmental impacts associated with material transportation.

8.2.1.4 General Requirements

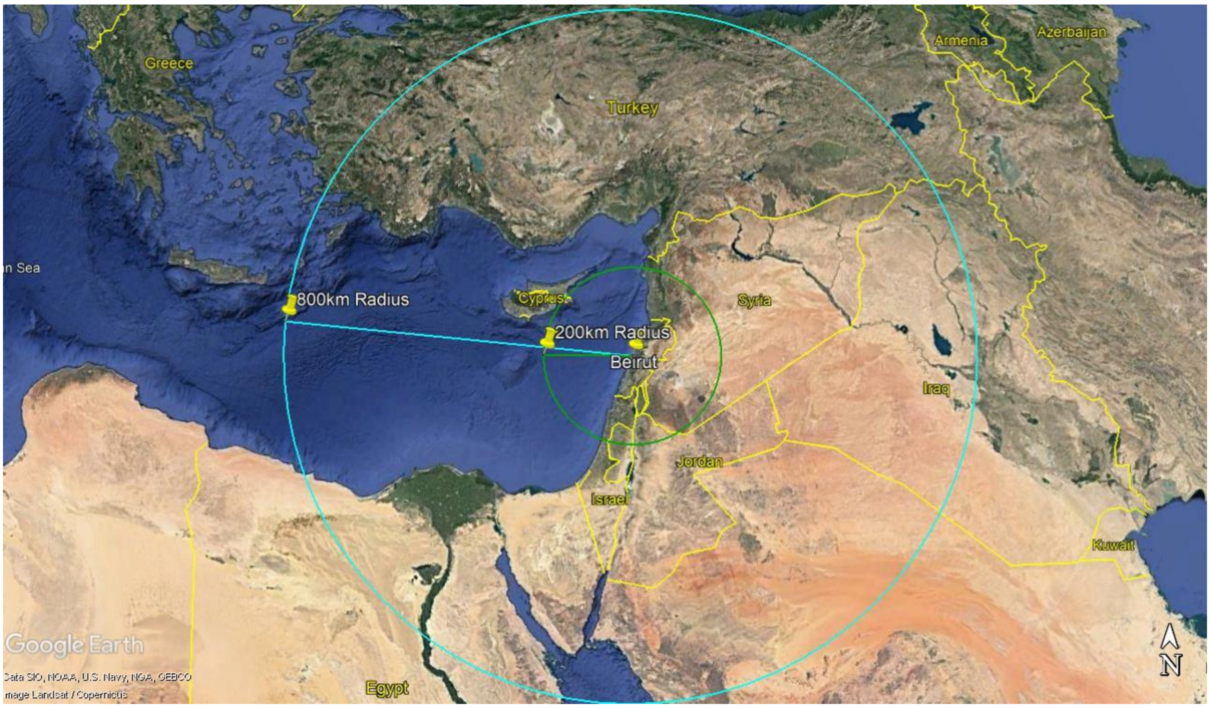
The use of local and regional construction materials reduces the environmental impacts and pollution associated with transportation whether by water, by air or by land. In addition, purchasing local products provides support to local manufacturers and working force, which retains the capital within the local community and contributes to a healthier economy.

Local construction materials are those which have been extracted or recovered, as well as manufactured within the Lebanese territories (i.e., within 200km from the project site). Since the Lebanese construction market greatly relies on imported products, any product sourced within a radius of 800km from the project site can also be considered as contributing to this criterion intent. The imported regional products should be extracted or recovered, as well as manufactured within the 800km radius. The following requirements should be considered:

- If raw materials are extracted within 200km from the project site and the final product is also manufactured within 200km from the project site, 100% of the volume of the materials used can contribute to the criterion score.
- If raw materials are extracted between 200km and 800km from the project site and the final product is manufactured within 200km from the project site, only 75% of the volume of the materials used can contribute to the criterion score.
- If raw materials are extracted within 800km from the project site and the final product is manufactured between 200km and 800km from the project site, only 50% of the volume of materials used can contribute to the criterion score.

- If raw materials are sourced beyond 800km from the project site, the final product cannot contribute to the criterion score even if manufacturing is done locally.

A map showing the 800km radius from Beirut is shown hereunder:



Only materials used in the following building construction elements are considered in the calculations for this criterion:

- External walls
- Internal walls
- Floor slabs
- Roof
- Windows.

The score for this criterion is determined based on the percentage of locally or regionally sourced materials by volume.

8.2.1.5 Special Requirements

None

8.2.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.2.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Project specifications	• The Project Specifications should (1) include the requirement to purchase local/regional materials, and (2) specify the required percentage by volume.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Bill of Quantities	• The Bill of Quantities should include all construction materials considered in this criterion, and the volume calculations for local/regional materials.
Letters from Suppliers	• The Letters from Suppliers should indicate (1) the location of both the extraction sites (for raw material), and the final product manufacturing plants (for every material), and (2) the distance which separates each one of them from the Project site itself.
Existing Building	
N/A	•

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.2.1.7 Score Allocation

The score for this criterion is determined based on the percentage of the locally or regionally sourced building materials by volume. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the Percentage of Local/Regional Materials by Volume ≥ 90%, $F_1 = 1$
  If the Percentage of Local/Regional Materials by Volume < 90%,

$$F_1 = \frac{Percentage\ of\ Local/Regional\ \ Materials\ \ by\, Volume}{0.9}$$

A project earns a score of 100% if the percentage of local/regional materials, by volume, is at least 90%.

8.2.2 Ma-2.2: Recycled Materials

8.2.2.1 Criterion Reference and Title

Ma-2.2: Recycled Materials

8.2.2.2 Criterion Type

Optional

8.2.2.3 Intent

To encourage the use of building products, which incorporate recycled materials, thereby reducing the demand for raw materials and the environmental impacts associated with the materials' extraction and processing.

8.2.2.4 General Requirements

Recycled content refers to the portion of materials, which are used in a product but have been diverted from the solid waste stream. Whether diverted waste or excess products from manufacturing processes, the materials are either considered (1) pre-consumer recycled content or (2) post-industrial recycled content. The pre-consumer recycled content refers to the materials, which have not reached any consumers yet. The post-consumer recycled content is derived from materials, which can no longer serve their original purpose. A post-consumer recycled content is a term, which designates materials extracted from products used by consumers and would otherwise be discarded as waste. These materials are recovered through consumer recycling.

Products with recycled content reduce the demand for virgin materials and solid waste volumes. Commonly used construction materials with recycled content include

- Metals (structural steel and steel panels)
- Concrete with supplementary cementing materials: Ground Granulated Blast Furnace Slag (GGBFS), fly ash and silica fumes
- Recycled aggregates
- Concrete masonry units
- Finishing materials: gypsum boards, floor tiles
- Glass panels
- Insulating materials.

Only materials used in the following building construction elements are considered in the calculations for this criterion:

- External walls
- Internal walls
- Floor slabs
- Roof
- Windows.

The score for this criterion is determined based on the percentage of recycled content in the materials used, by volume.

8.2.2.5 Special Requirements

None

8.2.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.2.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• Criterion narrative should give a brief description of the strategy implemented by the project team to meet this criterion's requirements.
Project specifications	• The Project Specifications should (1) include the requirement to purchase recycled materials, and (2) specify the required percentage of recycled content.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Bill of Quantities	• The Bill of Quantities should include (1) all construction materials considered in this criterion and (2) the volume calculations for the recycled content.
Letters from Suppliers	• The Letters from Suppliers should state the recycled content in each material.
Existing Building	
N/A	•

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. Project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.2.2.7 Score Allocation

The score for this criterion is determined based on the percentage of recycled content in the materials used, by volume. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the Percentage of Recycled Content in Materials by Volume ≥ 20%, $F_1 = 1$
  If the Percentage of Recycled Content in Materials by Volume < 20%,
  $F_1 = \frac{Percentage\ of\ Recycled\ Content\ in\ Materials\ by\ Volume}{0.2}$

A project earns a score of 100% if the percentage of recycled content in the materials used, by volume, is at least 20%.

8.2.3 Ma-2.3: Materials’ Environmental Impact

8.2.3.1 Criterion Reference and Title

Ma-2.3: Materials’ Environmental Impact

8.2.3.2 Criterion Type

Optional

8.2.3.3 Intent

To encourage the use of building materials, which have low embodied energy, thereby reducing the impacts associated with the extraction, processing and manufacturing of materials.

8.2.3.4 General Requirements

Embodied energy is the total energy consumed by all of the processes associated with the production of building materials, including the extraction of raw materials, and the processing and manufacturing of the final product. It is expressed in Mega Joules (MJ) per unit weight (kg) or unit volume (m^3) or unit area (m^2) of a building material.
Embodied energy considers only the front-end aspect of the impact of building materials; it does not evaluate the full life cycle impact, which should take into consideration the operational impacts and material disposal. Reducing embodied energy can significantly reduce the overall life cycle impact of the building.

Only materials used in the following building construction elements are considered in the calculations for this criterion:

- External walls
- Internal walls
- Floor slabs
- Roof
- Windows.

The embodied energy of the proposed materials is compared with the baseline embodied energy of each building element.

The baseline for each building element is defined in the table hereunder:

Building Element	Baseline Construction	Embodied Energy	Unit
External Wall	5. Hollow Concrete Block, normal mass aggregate	6. 1,454	7. MJ/m^3
Internal Wall	8. Hollow concrete block, normal mass aggregate	9. 1,454	10. MJ/m^3
Floor Slab	11. Concrete Cast, reinforced concrete	12. 4,608	13. MJ/m^3
Roof	14. Concrete Cast, reinforced concrete	15. 4,608	16. MJ/m^3
Windows	17. Double Glass Window with aluminum frame	18. Double glass: 382 19. Aluminum frame: 3,500	20. MJ/m^2 21. MJ/m^2

The score for this criterion is determined based on the reduction percentage in embodied energy of the selected building materials compared with the baseline materials.

The sample database for embodied energy of various building materials is included in the tables hereunder:

Database of Wall Construction Materials				
No.	Description	Density (kg/m^3)	Embodied energy (MJ/m^3)	Embodied energy (MJ/kg)
1	Air Space - Vertical Air Space, 1cm	-	0	0.00
2	Air Space - Vertical Air Space, 2cm	-	0	0.00
3	Air Space - Vertical Air Space, 5cm	-	0	0.00
4	Air Space - Vertical Air Space, 9cm	-	0	0.00
5	Asphalt - general	1700	6,800	4.00
6	Bitumen - general	2330	118,830	51.00
7	Brick - brick	1920	5,760	3.00
8	Brick - aerated	1000	3,000	3.00
9	Brick - pavior	2000	6,000	3.00
10	Brick - reinforced	1920	5,760	3.00
11	Cement	1860	10,230	5.50
12	Cement Mortar	1860	2,474	1.33
13	Cement Plaster	1600	2,128	1.33
14	Cement Plaster, sand aggregate	1860	2,474	1.33
15	Gypsum	1200	2,160	1.80

Database of Wall Construction Materials				
No.	**Description**	**Density (kg/m^3)**	**Embodied energy (MJ/m^3)**	**Embodied energy (MJ/kg)**
16	Gypsum Plaster	1120	2,016	1.80
17	Lime Plaster	1600	2,880	1.80
18	Plaster	1300	2,340	1.80
19	Plaster, sand aggregate	1680	3,024	1.80
20	Concrete Blocks - autoclaved aerated concrete block 500kg/m3	500	1,750	3.50
21	Concrete Blocks - autoclaved aerated concrete block 700kg/m3	700	2,450	3.50
22	Concrete Blocks - concrete block (dense)	2300	1,656	0.72
23	Concrete Blocks - Foamed Concrete Block	300	216	0.72
24	Concrete Blocks - Hollow Concrete Block, normal mass aggregate, 10 cm	2020	1,454	0.72
25	Concrete Blocks - Hollow Concrete Block, normal mass aggregate, 15 cm	2020	1,454	0.72
26	Concrete Blocks - Hollow Concrete Block, normal mass aggregate, 20 cm	2020	1,454	0.72
27	Concrete Blocks - Hollow Concrete Block, medium mass aggregate, 10 cm	1790	1,289	0.72
28	Concrete Blocks - Hollow Concrete Block, medium mass aggregate, 15 cm	1790	1,289	0.72
29	Concrete Blocks - Hollow Concrete Block, medium mass aggregate, 20 cm	1790	1,289	0.72
30	Concrete blocks - Hollow Concrete Block, low mass aggregate, 10 cm	1790	1,289	0.72
31	Concrete Blocks - Hollow Concrete Block, low mass aggregate, 15 cm	1390	1,001	0.72
32	Concrete Blocks - Hollow Concrete Block, low mass aggregate, 20 cm	1390	1,001	0.72
33	Concrete Blocks - Solid Concrete Block, 10 cm	2240	1,613	0.72
34	Concrete blocks - Solid Concrete Block, 15 cm	2240	1,613	0.72
35	Concrete Blocks - Solid Concrete Block, 20 cm	2240	1,613	0.72
36	Concrete, cast - reinforced concrete	2400	4,608	1.92
37	Concrete, cast - cellular, 480kg/m3	480	480	1.00

Database of Wall Construction Materials				
No.	**Description**	**Density (kg/m³)**	**Embodied energy (MJ/m³)**	**Embodied energy (MJ/kg)**
38	Concrete, cast - cellular, 700kg/m3	700	700	1.00
39	Concrete, cast - dense	2200	2,200	1.00
40	Concrete, cast - compacted,	2400	2,400	1.00
41	Concrete, cast - precast concrete (dense)	2100	4,893	2.33
42	Concrete, cast - cast concrete	2000	2,000	1.00
43	Concrete, cast - compacted	2500	2,500	1.00
44	Concrete, cast - foamed, 400kg/m3	400	400	1.00
45	Concrete, cast - foamed, 700kg/m3	700	700	1.00
46	Concrete, cast - glass reinforced	1950	1,950	1.00
47	Glass - general	2500	37,500	15.00
48	Glass - cellular sheet	2300	34,500	15.00
49	Insulation - expanded polystyrene (EPS)	25	2,215	88.60
50	Insulation - extruded polystyrene (XPS)	25	2,215	88.60
51	Insulation - polyisocyanate	45	4,590	102.00
52	Insulation - polyurethane	30	3,060	102.00
53	Insulation - polyvinylchloride	37	2,856	77.20
54	Insulation - rock wool	100	1,680	16.80
55	Insulation - mineral wool	140	2,324	16.60
56	Loose fill/powders - gravel	1840	153	0.08
57	Loose fill/powders - sand	2240	181	0.08
58	Loose fill/powders - white dry render	1300	105	0.08
59	Miscellaneous - wood blocks	650	6,500	10.00
60	Miscellaneous - aluminum cladding	7680	1,190,400	155.00
61	Miscellaneous - Linoleum	1200	30,000	25.00
62	Miscellaneous - Polyvinylchloride (PVC)	1380	106,536	77.20
63	Soil - earth, common	1460	657	0.45
64	Soil - earth, gravel-based	2050	923	0.45
65	Stone - basalt	2880	31,680	11.00
66	Stone - gneiss	2880	31,680	11.00
67	Stone - granite	2880	31,680	11.00
68	Stone - granite, red	2650	29,150	11.00
69	Stone - limestone	2600	3,900	1.50
70	Stone - marble	2800	5,600	2.00
71	Stone - sandstone	2600	2,600	1.00
72	Tiles - brick tiles	1890	5,670	3.00

Database of Wall Construction Materials

No.	Description	Density (kg/m^3)	Embodied energy (MJ/m^3)	Embodied energy (MJ/kg)
73	Tiles - ceramic tiles	2000	24,000	12.00
74	Tiles - ceramic tiles, glazed	2500	30,000	12.00
75	Tiles - clay tiles	1900	12,350	6.50
76	Tiles - concrete tiles	2100	2,100	1.00
77	Tiles - PVC tiles	1200	82,320	68.60
78	Tiles - Rubber tiles	1600	145,600	91.00
79	Tiles - sandstone tiles	2000	2,000	1.00
80	Tiles - terracotta tile	1700	5,100	3.00
81	Wood - Maple, Oak and similar hardwoods	720	7,488	10.40
82	Wood - Fir, Pine	510	5,100	10.00
83	Wood - hardwood	800	8,320	10.40
84	Wood - chipboard	430	4,730	11.00
85	Wood - hardboard	1000	16,000	16.00
86	Wood - particle board	1000	14,500	14.50
87	Wood - plywood	700	10,500	15.00
88	Wood - softboard	250	1,850	7.40
89	Wood - wallboard	260	3,120	12.00

Database of Floor/Roof Construction Materials

No.	Description	Density (kg/m^3)	Embodied energy (MJ/m^3)	Embodied energy (MJ/kg)
1	Air Space - Horizontal Air Space, Roof, 1cm		0	0.00
2	Air Space - Horizontal Air Space, Roof, 2m		0	0.00
3	Air Space - Horizontal Air Space, Roof, 5cm		0	0.00
4	Asphalt - general	1700	6,800	4.00
5	Asphalt - poured	2300	9,200	4.00
6	Asphalt - reflective coat	2100	8,400	4.00
7	Asphalt - roofing, mastic	2300	9,200	4.00
8	Bitumen - general	2330	118,830	51.00
9	Bitumen - composite, flooring	2400	122,400	51.00
10	Bitumen - insulation, all types	1000	51,000	51.00
11	Brick - brick	1920	5,760	3.00

Database of Floor/Roof Construction Materials

No.	Description	Density (kg/m³)	Embodied energy (MJ/m³)	Embodied energy (MJ/kg)
12	Brick - aerated	1000	3,000	3.00
13	Brick - pavior	2000	6,000	3.00
14	Brick - reinforced	1920	5,760	3.00
15	Cement	1860	10,230	5.50
16	Cement mortar	1860	2,474	1.33
17	Cement plaster	1600	2,128	1.33
18	Cement Plaster, sand aggregate	1860	2,474	1.33
19	Cement Screed	2100	2,793	1.33
20	Gypsum	1200	2,160	1.80
21	Gypsum Plaster	1120	2,016	1.80
22	Lime Plaster	1600	2,880	1.80
23	Plaster	1300	2,340	1.80
24	Plaster, sand aggregate	1680	3,024	1.80
25	Screed	1200	2,160	1.80
26	Concrete blocks - Slab Filler Hollow Concrete blocks (Hourdi) 14 cm	1790	1,289	0.72
27	Concrete blocks - Slab Filler Hollow Concrete blocks (Hourdi) 18 cm	1790	1,289	0.72
28	Concrete blocks - Slab Filler Hollow Concrete blocks (Hourdi) 22 cm	1790	1,289	0.72
29	Concrete blocks - Slab Filler Hollow Concrete blocks (Hourdi) 24 cm	1790	1,289	0.72
30	Concrete blocks - Slab Filler Hollow Concrete blocks (Hourdi) 32 cm	1790	1,289	0.72
31	Concrete, cast - reinforced concrete	2400	4,608	1.92
32	Concrete, cast - cellular, 480kg/m3	480	480	1.00
33	Concrete, cast - cellular, 700kg/m3	700	700	1.00
34	Concrete, cast - dense	2200	2,200	1.00
35	Concrete, cast - compacted,	2400	2,400	1.00
36	Concrete, cast - precast concrete (dense)	2100	4,893	2.33
37	Concrete, cast - cast concrete	2000	2,000	1.00

Database of Floor/Roof Construction Materials				
No.	**Description**	**Density (kg/m^3)**	**Embodied energy (MJ/m^3)**	**Embodied energy (MJ/kg)**
38	Concrete, cast - compacted	2500	2,500	1.00
39	Concrete, cast - foamed, 400kg/m3	400	400	1.00
40	Concrete, cast - foamed, 700kg/m3	700	700	1.00
41	Concrete, cast - glass reinforced	1950	1,950	1.00
42	Glass - general	2500	37,500	15.00
43	Glass - cellular sheet	2300	34,500	15.00
44	Insulation - expanded polystyrene (EPS)	25	2,215	88.60
45	Insulation - extruded polystyrene (XPS)	25	2,215	88.60
46	Insulation - polyisocyanate	45	4,590	102.00
47	Insulation - polyurethane	30	3,060	102.00
48	Insulation - polyvinylchloride	37	2,856	77.20
49	Insulation - rock wool	100	1,680	16.80
50	Insulation - mineral wool	140	2,324	16.60
51	Loose fill/powders - floor/roof screed	1200	1,596	1.33
52	Loose fill/powders - gravel	1840	153	0.08
53	Loose fill/powders - roof gravel or slag	880	73	0.08
54	Loose fill/powders - sand	2240	181	0.08
55	Loose fill/powders - white dry render	1300	105	0.08
56	Miscellaneous - vinyl floor covering	1200	78,768	65.64
57	Miscellaneous - wood blocks	650	6,500	10.00
58	Miscellaneous - aluminum cladding	7680	1,190,400	155.00
59	Miscellaneous - Linoleum	1200	30,000	25.00
60	Miscellaneous - Polyvinylchloride (PVC)	1380	106,536	77.20
61	Soil - earth, common	1460	657	0.45
62	Soil - earth, gravel-based	2050	923	0.45
63	Stone - basalt	2880	31,680	11.00
64	Stone - gneiss	2880	31,680	11.00
65	Stone - granite	2880	31,680	11.00
66	Stone - granite, red	2650	29,150	11.00
67	Stone - limestone	2600	3,900	1.50
68	Stone - marble	2800	5,600	2.00
69	Stone - sandstone	2600	2,600	1.00
70	Tiles - brick tiles	1890	5,670	3.00
71	Tiles - ceramic tiles	2000	24,000	12.00
72	Tiles - ceramic tiles, glazed	2500	30,000	12.00
73	Tiles - ceramic floor tiles	1700	20,400	12.00

Database of Floor/Roof Construction Materials				
No.	**Description**	**Density (kg/m^3)**	**Embodied energy (MJ/m^3)**	**Embodied energy (MJ/kg)**
74	Tiles - clay tiles	1900	12,350	6.50
75	Tiles - concrete tiles	2100	2,100	1.00
76	Tiles - plaster ceiling tiles	1120	7,560	6.75
77	Tiles - PVC tiles	1200	82,320	68.60
78	Tiles - roof tile	1900	2,660	1.40
79	Tiles - Rubber tiles	1600	145,600	91.00
80	Tiles - sandstone tiles	2000	2,000	1.00
81	Tiles - terracotta tile	1700	5,100	3.00
82	Wood - Maple, Oak and similar hardwoods	720	7,488	10.40
83	Wood - Fir, Pine	510	5,100	10.00
84	Wood - hardwood	800	8,320	10.40
85	Wood - chipboard	430	4,730	11.00
86	Wood - flooring blocks	650	6,175	9.50
87	Wood - hardboard	1000	16,000	16.00
88	Wood - particle board	1000	14,500	14.50
89	Wood - plywood	700	10,500	15.00
90	Wood - softboard	250	1,850	7.40

Database of Window Materials		
No.	**Description**	**Embodied energy (MJ/m^2)**
1	Glass - Single glass	191.00
2	Glass - Double glass	382.00
3	Glass - Triple glass	573.00
4	No Frame	0.00
5	Aluminum Frame	3,500.00
6	Steel Frame	572.00
7	Timber Frame	169.00
8	UPVC Frame	1,340.00
9	Aluminum clad timber Frame	570.00

8.2.3.5 Special Requirements

None

8.2.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.2.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Project Specifications	- The Project Specifications should (1) include the requirement to select materials with low embodied energy, and (2) specify the required reduction percentage in embodied energy over the baseline.
New Building in Construction Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Bill of Quantities	- The Bill of Quantities should (1) include all the construction materials considered in this criterion and (2) the volume calculations of each material.
Existing Building	
N/A	•

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.2.3.7 Score Allocation

The score for this criterion is determined based on the reduction percentage in embodied energy of all considered building materials compared with the baseline. The reduction percentage is calculated using the following formula:

$$Percentage\ Reduction\ in\ Embodied\ Energy = \frac{Total\ Baseline\ Materials\ Embodied\ Energy - Total\ Proposed\ Materials\ Embodied\ Energy}{Total\ Baseline\ Materials\ Embodied\ Energy}$$

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:

If the Reduction Percentage in Embodied Energy ≥ 20%, $F_1 = 1$

If the Reduction Percentage in Embodied Energy < 20%,

$$F_1 = \frac{Percentage\ Reduction\ in\ Embodied\ Energy}{0.2}$$

A project earns a score of 100% if the reduction percentage in embodied energy compared with the baseline is at least 20%.

8.2.4 Ma-2.4: Materials’ Durability and Maintenance

8.2.4.1 Criterion Reference and Title

Ma-2.4: Materials’ Durability and Maintenance

8.2.4.2 Criterion Type

Optional

8.2.4.3 Intent

To reduce the environmental impacts associated with building materials maintenance through selecting durable materials and implementing measures to protect building vulnerable components, thereby reducing the demand for raw materials.

8.2.4.4 General Requirements

Durability is a key factor to consider when assessing the environmental impact associated with the selection of building materials. Selecting a material with low initial environmental impact, which must be replaced frequently (short life), may have a greater overall impact compared to a durable long-life material with higher initial environmental impacts. High maintenance materials requiring frequent maintenance may also have higher overall environmental impact compared to low maintenance materials. Properly considering durability at the project design stage will ensure that premature materials and system failure are avoided, and the environmental impacts associated with materials’ maintenance and replacement are minimized.

The steps to follow when assessing the materials’ durability and maintenance requirements:

- Identify the environmental conditions which materials will be exposed to.
- Assess the effect of these conditions on building materials’ durability.
- Ensure that the proposed materials are suitable for the operating conditions.
- Assess the maintenance requirements for the proposed materials, and make sure that low maintenance materials are selected.
- Explore additional measures, which can protect building materials and expand their service life.

Potential measures to improve durability, and to increase building service life include

- Protecting the vulnerable parts of the building (i.e., bollards/barriers in vehicle circulation areas, protection rails on walls, kick plates on doors, heavy-duty floor finishes in high circulation areas, etc.)
- Waterproofing the building envelope and protecting it from leakage (i.e., proper roof sloping and drainage, roof waterproofing, heavy-duty waterproof finishes for exterior walls, etc.)
- Installing a drainage system for the building foundation and the retaining walls
- Installing UV and high temperature-resistant building envelope finishes
- Providing an ease of access and maintenance to building elements (i.e., maintenance program, access platforms)
- Protecting the building from pests and insects (i.e., proper waste disposal, insect screens on building openings, etc.)
- Protecting the building from unwanted vegetation growth and damage (i.e., root barriers, etc.)
- Protecting the building from other contaminants, which may affect building durability.

The score for this criterion is determined based on the compliance with the building durability measures.

8.2.4.5 Special Requirements

None

8.2.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.2.4-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should include the proposed design features, which improve building maintenance and materials’ durability.
Project Specifications	• The Project Specifications should include the requirement to select materials, which meet the durability requirements.
Material Durability and Maintenance Plan	• The Materials’ Durability and Maintenance Plan should include an assessment of the building’s environmental conditions and their potential impact on building materials,

Submittal Name	Submittal Description
	along with the proposed measures and maintenance procedures required to improve the materials durability and to increase the building service life.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should include the implemented features, which improve building maintenance and materials' durability.
Manufacturer Datasheets	• The Manufacturer Materials' Datasheets should be provided for all the installed products, which prove building maintenance and materials' durability.
Existing Building	
N/A	•

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.2.4.7 Score Allocation

Weight factors are applied to each requirement as follows:

Measures to Improve Durability and Increase Building Service Life			
No.	**Measure Description**	**Weight Factor (WF)**	
1	Protection of vulnerable parts of the building (i.e., bollards/barriers in vehicle circulation areas, protection rails on walls, kick plates on doors, heavy-duty floor finishes in high circulation areas, etc.)	WF_1	1
2	Building envelope waterproofing and leakage protection (i.e., proper roof sloping and drainage, roof waterproofing, use of heavy-duty waterproof finishes for exterior walls, etc.)	WF_2	1
3	Drainage system for building foundation and retaining walls	WF_3	1
4	Ultra-violet radiations (UV) and high temperature-resistant building envelope finishes	WF_4	1
5	Ease of access and maintenance to building elements (i.e., maintenance program, access platforms)	WF_5	1

6	Protection against pests and insects (i.e., proper waste disposal, insect screens on building openings, etc.)	WF_6	1
7	Protection against unwanted vegetation growth and damage (i.e., root barriers, etc.)	WF_7	1
8	Protection against other contaminants, which may affect building durability.	WF_8	1

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * \ Weighted\ Average\ Score$$

Where:

- F_1 is calculated using the following formula:
  If the project provided a building durability and maintenance plan, $F_1 = 1$
  If the project did not provide a building durability and maintenance plan, $F_1 = 0$

The weighted average score for compliance with the requirements is calculated using the following formula:

$$Weighted\ Average\ Score = \frac{\sum Weight\ Factors\ of\ compliant\ reuirements}{\sum Weight\ Factors\ of\ all\ requirements}$$

A project earns a score of 100% for this criterion by providing a building durability and maintenance plan, and implementing all the measures required by this criterion.

8.2.5 Ma-2.5: Materials’ Reuse

8.2.5.1 Criterion Reference and Title

Ma-2.5: Materials’ Reuse

8.2.5.2 Criterion Type

Optional

8.2.5.3 Intent

To encourage reuse of building materials, thereby reducing the demand for raw materials and the environmental impacts associated with the extraction and processing of materials.

8.2.5.4 General Requirements

The use of salvaged, refurbished or reused materials would reduce the demand for virgin materials, and would also reduce the environmental impacts associated with the production process. It also diverts materials from construction waste streams.

Opportunities to incorporate salvaged materials into the building design should be identified during the design stage. Only materials used in the following building construction elements are considered in the calculations for this criterion:

- External walls
- Internal walls
- Floor slabs
- Roof
- Windows.

The score for this criterion is determined based on the percentage of reused materials by volume.

8.2.5.5 Special Requirements

None

8.2.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.2.5-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Project Specifications	• The Project Specifications should (1) include the requirement to incorporate reused materials, and (2) specify their percentage by volume.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Bill of Quantities	• The Bill of Quantities should include (1) all the construction materials considered in this criterion, and (2) the volume calculations for the reused materials.
Letters from Suppliers	• The Letters from Suppliers should state the source of the reused materials.
Existing Building	
N/A	•

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.2.5.7 Score Allocation

The score for this criterion is determined based on the percentage of reused materials by volume. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the Percentage of Reused Materials by Volume ≥ 20%, $F_1 = 1$
  If the Percentage of Reused Materials by Volume < 20%,
  $$F_1 = \frac{Percentage\ of\ Reused\ Materials\ by\ Volume}{0.2}$$

A project earns a score of 100% if the percentage of reused materials by volume is at least 20%.

8.2.6 Ma-2.6: Certified Sustainable Materials

8.2.6.1 Criterion Reference and Title

Ma-2.6: Certified Sustainable Materials

8.2.6.2 Criterion Type

Optional

8.2.6.3 Intent

To reduce the environmental impacts associated with building materials by selecting certified sustainable materials.

8.2.6.4 General Requirements

Several certification schemes have been established in order to evaluate the sustainable aspects of construction materials in an objective manner. Independent or third party assessment ensures that green claims are measurable, and that products and services meet performance standards, and are appropriate for their intended use. This is important for both, the specifier who needs to fulfil a sustainability brief, and for the supplier who wants to demonstrate green credentials.
Hereunder is a list of certification schemes covering wood products:

- FSC (Forest Stewardship Council)
- PEFC (Program for the Endorsement of Forest Certification)
- SFI (Sustainable Forestry Initiative)
- MTCS (Malaysian Timber Certification Scheme)
- CSA-SFM (Canadian Standards Association – Sustainable Forest Management)
- Others.

The aforementioned certification schemes are designed to verify and confirm that wood products are sourced from responsibly managed forests, which provide environmental, social and economic benefits.

The score for this criterion is determined based on the percentage of the wood materials certified under a sustainable forest management scheme by volume.

8.2.6.5 Special Requirements

None

8.2.6.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.2.6-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Project Specifications	• The Project Specifications should (1) include the requirement to select certified sustainable materials, and (2) specify their percentage by volume.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Bill of Quantities	• The Bill of Quantities should include (1) all the materials considered in this criterion and (2) the volume calculations of each material.
Materials' Certificates	• Sustainability certificates should be presented for all materials claiming compliance with this criterion.
Existing Building	
N/A	•

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.2.6.7 Score Allocation

The score for this criterion is determined based on the percentage by volume of the wood materials, which are certified under a sustainable forest management scheme. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the percentage of Certified Sustainable Materials by Volume ≥ 90%, $F_1 = 1$

If the percentage of Certified Sustainable Materials by Volume < 90%,

$$F_1 = \frac{Percentage\ of\ Certified\ Sustainable\ \ Materials\ \ by\ Volume}{0.9}$$

A project earns a score of 100% if the percentage of certified sustainable materials by volume is at least 90%.

8.3 Family: Management and Operations

8.3.1 Ma-3.1: Recycling

8.3.1.1 Criterion Reference and Title

Ma-3.1: Recycling

8.3.1.2 Criterion Type

Optional

8.3.1.3 Intent

To segregate the building waste and channel it to recycling facilities to recover potentially useful material and reduce the use of fresh raw material. On a broader view, to implement a well-defined Waste Management Policy (WMP) addressing the consumption of materials, which go in and out of the Facility during its lifecycle.

8.3.1.4 General Requirements

Develop a Recycling Policy or a Waste Management Policy, which demonstrates top management commitment for Recycling in the Facility. The Policy shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner's Association signatory (Residential Sector). The Recycling or Waste Management Policy shall indicate top management commitment to waste recycling in a Mission Statement, and shall require the applicant to do the following:

- Have a Recycling or Waste Management Plan
- Address spreading awareness among all occupants
- Designate a Recycling or Waste Management Champion in charge of implementing a recycling or Waste Management Plan
- Require the measurement of Key Performance Indicators (KPIs) to evaluate and validate that the desired targets are achieved.

The Policy shall have the following sections:

Waste Management Plan

A Waste Management Plan addresses the 3 pillars of waste management or 3Rs: **R**educe, **R**euse, and **R**ecycle.

Develop a Waste Management Plan honoring the intent of this criterion. Include awareness campaigns, evaluation of performance, and improvements.

To serve the purpose of this criterion, the Waste Management Plan shall identify (as a minimum)

- The basic waste streams at the facility, such as
  - General Waste
  - Paper
  - Cardboard
  - Glass
  - Plastic
- All other waste streams, which can be recycled, such as
  - Food Waste
  - Metals (Tin, Aluminum, And Steel Cans)
  - Bulbs and Lamps
  - Fabric Textile and Furniture
  - Tires
  - Steel
  - Glass Panes
  - Composting
  - Equipment Lubricants
  - Cooking Oil.
- Applicable recycle bins marked for various streams
- Storage areas as categorized in the Waste Management Plan for all waste streams with the access requirements to them.

Mission Statement

Develop a Mission Statement, which includes/states measurable initiatives to demonstrate a commitment to waste-recycling, and to educate building tenants on waste-recycling.

Nominated Recycling or Waste Management Champion

The Facility shall have a nominated Recycling or Waste Management Champion to implement the Waste Management Plan and its initiatives.

- The champion is either an employee of the Facility, a resident of the Facility (Residential Sector) or otherwise subcontracted. He should report to the head of the Applicant's organization or the Owners' Association (Residential Sector).
- He can either be a dedicated manager or officer, or a staff member who takes on this role in addition to other roles in the Facility.
- The job requirements should include the following minimum tasks:
  - Enforce the Waste Management Policy

  - Raise awareness
  - Measure KPIs and achieve the recycling targets
  - Ensure the execution of the Applicant's initiatives as indicated in the Mission Statement.
- The champion shall be a qualified individual or entity, who is certified from an industry recognized certification body in sustainability, environmental health and safety, or in Facility management, with a minimum of 6 years of experience.

Measurement of KPIs

The Facility shall have a methodology to monitor waste recycling per waste stream. For example, the measurement of the percentage by weight of recycled paper versus the total paper consumption at the Facility.

The Facility shall set targets for waste recycling to be met on a yearly basis. These targets shall tackle the weaknesses in the waste management plan and develop improvements or changes. Demonstrate the effectiveness of the waste management plan in recycling through KPIs:

New Building

Make a prior binding commitment to submit necessary records for three consecutive years, starting no later than the date of applying for certification.

Existing Building

Provide necessary records for three consecutive years, which could be either pre or post certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive.

In case of a post-certification record submittal, a prior binding commitment is required.

Comply with the following additional requirements

Segregation of waste streams

Visible recycle bins or containers shall be provided for general use allowing for the separation of the following applicable waste streams:

- General waste (Trash)
- Paper and cardboard
- Glass and plastic

These recycle bins or storage containers must be clearly marked by stream and associated with a different color each: i.e., black for general waste, green for paper and cardboard, and blue for glass and plastic.

Recycle Bins must be coupled/tripled as necessary, and must be evenly distributed throughout the public areas for general public use.

Dedicated Waste Storage Area

A dedicated and sufficiently-sized area for the storage of various waste streams shall be made available.

Separation of waste streams must be provided within the storage area. The storage area must be sized to accommodate large storage containers for the various streams for at least one collection cycle. The calculations, which are used to demonstrate that the provided area is adequately-sized to handle the recyclable waste streams, must be based on

- The rate of waste generation by building
- The collection frequency for each waste stream
- The number of building occupants and estimated visitors
- The number of waste streams.

It is acceptable to provide more than one dedicated storage area to provide the total appropriate waste storage space for the building. However, all dedicated storage areas must meet the criteria hereunder.

The waste storage area(s) shall be

- Allocated an easy access for waste collection within the parameters of the best practice requirements developed by the waste collection party
- Allocated a car park designated for the recyclables’ transportation vehicle
- Designed/refurbished respecting the building fire safety strategy
- Provided with:

    - A non-slip floor surface
    - Adequate ventilation to reduce any potential odor generation
    - Large entrance doors to cater for the easy extraction of the collection bins to the transportation vehicle — the doors shall be lockable, fire-rated for 2 hours and equipped with door closers.
    - A sloped floor to a central foul drain for bin washing run-offs
    - Access control to nominated personnel only

  - Appropriate signage, placed above and on bins indicating the correct use of each stream.

Memorandum of Understanding:
Establish memoranda of understanding with qualified and licensed service providers for recyclables.

8.3.1.5 Special Requirements

None

8.3.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.3.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Recycling or Waste Management Policy	• A simple outline of the Recycling or Waste Management Policy should include one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The measurement of KPIs ○ The job description of the waste reduction or waste management champion
Drawings	• The Architectural/MEP Drawings should highlight all the relevant areas referenced by the waste management plan (e.g., location and types of waste bins, location and features of the dedicated waste storage area, etc.).
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Recycling or Waste Management Policy	• The Recycling or Waste Management Policy should include one or more of the following: ○ The Mission Statement

Submittal Name	Submittal Description
	○ The Waste Management Plan ○ The measurement of KPIs ○ The job description of the waste reduction or waste management champion
Drawings	• The Architectural/MEP drawings should highlight all the relevant areas referenced by the Waste Management Plan (e.g., location and types of waste bins, location and features of the dedicated waste storage area, etc.).
MOUs	• The memoranda of understanding with qualified and licensed service providers to collect and recycle the different waste streams should be provided.
Name and Qualifications of the Recycling or Waste Management Champion	• The name and the qualifications of the recycling or waste management champion should be provided.
Evaluation reports of Recycling KPIs	• The Evaluation Reports should include the monitoring and measurement of KPIs for waste streams. A prior binding commitment is required if the submitted KPIs are for the three consecutive post-certification years.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Recycling or Waste Management Policy	• The Recycling or Waste Management Policy includes one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The measurement of KPIs ○ The job description of the waste reduction or waste management champion
Drawings	• The Architectural/MEP Drawings should highlight all the relevant areas referenced by the Waste Management Plan (e.g., location and types of waste bins, location and features of the dedicated waste storage area, etc.).
MOUs	• The memoranda of understanding with qualified and licensed service providers to collect and recycle the different waste streams should be provided.
Name and Qualifications of the	• The name and the qualifications of the recycling or waste management champion should be provided.

Submittal Name	Submittal Description
Recycling or Waste Management Champion	
• Evaluation Reports of Recycling KPIs	• The Evaluation Reports should include the monitoring and measurement of KPIs for waste streams. A prior binding commitment to provide the KPIs for the balance of the required three consecutive years is required.
Evaluation Reports of Recycling Targets	• The evaluation reports shall ○ Evaluate the KPIs in the Waste Management Plan by tackling areas of improvements or areas with needed changes ○ Include the status of the targets indicated in the Mission Statement ○ Demonstrate the achievement of this target, or prove that the target is on track.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.3.1.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 8.3.1-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Does the Facility have a Recycling Policy?	1	Yes / No	1 / 0	2
Does the Policy include a Mission Statement with targets to be met?	2	Yes / No	1 / 0	2
Does the Policy require a nominated recycling champion?	3	Yes / No	1 / 0	2
Does the Facility have two waste bins per office desk, and a separate waste bin for paper, plastic, and general waste per public spaces?	4	Yes / No	1 / 0	2

Parameter	**Parameter No (i)**	**Status**	**Factor “F_i”**	**Weight Factor “WF_i”**
Does the Facility have dedicated waste storage areas?	5	Yes / No	1 / 0	2
Does the Facility have contracts or nominated service providers for the following recyclables?				
Paper and Cardboard	6	Yes / No	1/0	1
Metals: Tin, Aluminum, and Steel Cans	7	Yes / No	0/0	2
Rigid Plastics and Bottles	8	Yes / No	1/0	1
Glass Bottles and Jars	9	Yes / No	1/0	1
Bulbs and Lamps	10	Yes / No	0/0	2
Fabric, Textile, and Furniture	11	Yes / No	0/0	2
Tires	12	Yes / No	0/0	2
Steel	13	Yes / No	1/0	1
Glass Panes	14	Yes / No	1/0	2
Composting	15	Yes / No	1/0	2
Equipment Lubricants and Cooking Oil	16	Yes / No	1/0	2

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{16}(F_i * WF_i)}{\sum_{i=1}^{16} WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

8.3.2 Ma-3.2: Waste Reduction

8.3.2.1 Criterion Reference and Title

Ma-3.2 Waste Reduction

8.3.2.2 Criterion Type

Optional

8.3.2.3 Intent

To implement a well-defined waste reduction methodology addressing the consumption of material at the Facility during its lifecycle. To reduce the use of fresh new material. On a broader view, to implement a well-defined Waste Management Policy (WMP) addressing the consumption of materials, which go in and out of the Facility during its lifecycle.

8.3.2.4 General Requirements

Develop a Waste Reduction Policy or a Waste Management Policy, which demonstrates the top management's commitment to waste reduction in the Facility. The Policy shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner's Association signatory (Residential Sector). The Waste Reduction or Waste Management Policy shall require from (1) top management to commit to reducing waste in a Mission Statement, and (2) the Applicant to commit to

- Having a Waste Reduction or Waste Management Plan
- Spreading awareness among all the occupants
- Designating a Waste Reduction or Waste Management Champion in charge of implementing a Recycling or Waste Management Plan
- Requiring the measurement of Key Performance Indicators (KPIs) in order to evaluate and validate the achievement of the desired targets.

The Policy shall have the following sections:

The Waste Management Plan

Develop a Waste Management Plan, which

- Addresses the 3 pillars of waste management (3Rs): **R**educe, **R**euse, and **R**ecycle
- Honors the intent of this criterion
- Includes awareness campaigns, evaluation of performance, and improvements.

To serve the purpose of this criterion, the Waste Management Plan shall

- Identify the different waste streams at The Facility
- Implement methodologies to reduce the consumption of material, where possible
- Implement methodologies to reuse material instead of directing it for disposal.

Implement various approaches to

- Limit paper consumption:
    - Restrain the use of hardcopy mail, receipts, magazines, etc.
    - Encourage printing, only when necessary.
    - Use duplex printing and copying, if needed.
    - Optimize organizational processes to reduce printing.
    - Automate processes to eliminate printing.
    - Reuse envelopes, binders, and folders.
- Use Non-disposables:
    - Encourage the use of reusable mugs, cups, cutlery, and bottles.
    - Encourage the use of reusable shopping bags and food containers.
- Act responsibly:
    - Ship goods directly to the point of use to reduce packaging material due to multiple shipping.
    - Buy second-hand items and donate the unwanted items.

Mission Statement

Develop a Mission Statement, which states measurable initiatives (1) to demonstrate a commitment to waste reduction, and (2) to educate building tenants to reduce waste generation.

Nominated Waste Reduction or Waste Management Champion

The Facility shall have a nominated Waste Reduction or Waste Management Champion to implement the Waste Management Plan and its initiatives.

- The Champion is either an employee of the Facility, a resident of the Facility (Residential Sector) or otherwise subcontracted. He should report to the head of the Applicant's organization or the Owners' Association (Residential Sector).
- He can either be a dedicated manager or officer or a staff member who takes on this role in addition to other roles in the Facility.
- The job requirements should include the following minimum tasks:
    - Enforcing the Waste Reduction Policy
    - Raising awareness
    - Measuring KPIs and achieving the waste reduction planned targets

  - Ensuring the execution of the Applicant's initiatives as indicated in the Mission Statement.
- The Champion shall be a qualified individual or entity, who is certified from an industry recognized certification body in sustainability, environmental health and safety, or in Facility management, with a minimum of 6 years of experience.

Measurement of KPIs

The Facility shall have a methodology for the measurement of Waste Reduction Key Performance Indicators (KPIs). One example would be to measure the Waste Reduction Rates month-on-month.

The Facility shall set targets for waste reduction rate on a yearly basis. These targets shall tackle the weaknesses in the Waste Management Plan and shall develop necessary improvements or changes.

Demonstrate the effectiveness of the Waste Management Plan in waste reduction through KPIs:

New Building

Make a commitment to submit necessary records for three consecutive years, starting no later than the date of applying for certification.

Existing Building

Provide necessary records for three consecutive years, which could be either pre or post certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive. In case of a post-certification record submittal, a prior binding commitment is required.

8.3.2.5 Special Requirements

None

8.3.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.3.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Waste Reduction or Waste Management Policy	• A simple outline of the Waste Reduction or Waste Management Policy should include one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The measurement of the KPIs ○ The job description of the Waste Reduction or Waste Management Champion.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Waste Reduction or Waste Management Policy	• The Waste Reduction or Waste Management Policy should include one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The measurement of the KPIs ○ The job description of the waste reduction or Waste Management Champion
Name and Qualifications of the Waste Reduction Champion	• The name and the qualifications of the Waste Reduction or Waste Management Champion should be provided.
Evaluation Reports of Waste Reduction KPIs	• The Evaluation Reports shall monitor and measure the KPIs for waste reduction. A prior binding commitment to provide the KPIs for the three consecutive post-certification years is required.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
Waste Reduction or Waste Management Policy	• Waste Reduction or Waste Management Policy, which includes one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The Measurement of KPIs ○ The job description of the waste reduction or Waste Management Champion
Name and Qualifications of the Waste Reduction Champion	• The name and the qualifications of the Waste Reduction or Waste Management Champion should be provided.
Evaluation Reports of Waste Reduction KPIs	• The Evaluation Reports of waste reduction should include the monitoring and the measurement of KPIs for waste reduction. A prior binding commitment to provide the KPIs for the balance of the required three consecutive years is necessary.
Evaluation Report of Waste Reduction Targets	• Evaluate the KPIs, which tackle areas of improvements or changes needed in the Waste Management Plan. • Submit the Evaluation Reports on the status of the targets indicated in the Mission Statement. • Demonstrate the achievement of this target, or prove that the target is on track.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.3.2.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 8.3.2-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Does the Facility have a Policy for Waste Reduction?	1	Yes / No	1 / 0	1
Does the Policy include a Mission Statement with targets to be met?	2	Yes / No	0 / 0	1
Does the Policy require a nominated Champion?	3	Yes / No	1 / 0	1
Does the Policy prioritize the purchase of reusable items over single use items?	4	Yes / No	1 / 0	1
Does the Facility have procedures, which include the following waste reduction approaches?				
Duplex printing	5	Yes / No	1 / 0	1
Process optimization to reduce printing	6	Yes / No	1 / 0	1
Automation towards a paperless environment	7	Yes / No	1 / 0	1
Reuse of envelopes, binders, folders	8	Yes / No	1 / 0	1
Use of non-disposable cups and cutlery, etc.	9	Yes / No	1 / 0	1
Use of reusable items for food storage	10	Yes / No	1 / 0	1
Shipment to the point of use	11	Yes / No	1 / 0	1
Reduction of the use of packaging materials	12	Yes / No	1 / 0	1

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{12}(F_i * WF_i)}{\sum_{i=1}^{12} WF_i}\right]$$

A project earns a score of 100% by complying to each of the aforementioned requirements.

8.3.3 Ma-3.3: Awareness of Waste Management

8.3.3.1 Criterion Reference and Title

Ma-3.3 Awareness of Waste Management

8.3.3.2 Criterion Type

Optional

8.3.3.3 Intent

To conduct well-defined awareness campaigns for Waste Management. To implement the Waste Management Plan respecting the 3 pillars (3Rs) Reduce, Reuse and Recycle, through regular awareness campaigns.

8.3.3.4 General Requirements

Conduct awareness campaigns for waste management to communicate the Waste Management Policy and the 3 pillars (3Rs) for waste management: Reduce, Reuse and Recycle.

In carrying out awareness campaigns

- Ensure continuity, consistency, complementarity and clarity of all the communications and keep well-defined objectives
- Create clear occupant-centered messages when tackling key challenges
- Ensure efficient delivery through the integration of different communication tools and clear lines of responsibility.

The Elements of Waste Management Awareness

The Mission Statement

Set the awareness campaign mission, objectives and key challenges through effective communication. The best-practice in these awareness-raising campaigns is to effectively encourage waste reduction, reuse and recycling behavior to become a daily norm.

The Awareness Campaign Plan

The Awareness Campaign Plan shall address the annual activities for waste reduction, reuse and recycle. It shall be designed with the intent to achieve the mission objectives by improving the effectiveness of communication, and by involving building occupants /tenants in awareness activities.

The following should be considered as a minimum:

- Conduct at least one awareness campaign per year making use of different marketing tools i.e., emails, posters, banners, social media coverage, events, door-to-door, and through awareness activities.
- Identify the roles and responsibility of the Facility occupants' in delivering and reviewing the Waste Management Plan through recurrent awareness campaigns.
- Implement a reward system to raise the tenants' awareness and keep them engaged. For example, use smart plastic bottle recycling containers, which can identify the quantity, which was deposited, the person who made the deposit, and connect it to redemptions or discounts.
- Identify a well-designed signage system to encourage building tenants to practice waste management as a lifestyle.

Awareness Activities

During the awareness campaigns, several awareness activities shall be carried out, such as, but not limited to:

- Activity (1) - Branding / Promotional themes
  Objective: To better acquaint the Facility occupants with waste management, and to introduce linking programs and initiatives.

- Activity (2) - Marketing and promotions
  Objective: To offer tangible proof that recycling does work by showcasing products made from recycled material.

- Activity (3) -Listing popular recyclable products
  Objective: To highlight which products and materials are recyclable.

- Activity (4)- Setting a community-based volunteer program
  Objectives: To spur people into thinking about waste reduction, and to show them how easy it is to participate in recycling.
  To Train volunteer tenants to initiate face-to-face communication within their community and to raise awareness about the benefits of recycling.

- Activity (5)- Using celebrity branding or celebrity endorsement
  Objective: To communicate key messages using a celebrity's fame or social status to raise awareness about waste management. A public figure resident in the facility can promote the 3Rs by delivering positive and encouraging messages through talk shows, social media platforms and word-of-mouth.

- Activity (6) - Creating a website or social media presence
  Objective: To provide links to the service providers' websites or social media platforms by setting up a central website or social media platform linked to the promotional themes/branding. This electronic presence is more far-reaching.

Awareness Budget

The Facility shall have an approved five-year budget for Waste Management Awareness campaigns. The approved budget should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.

Occupant Feedback

The project team has to conduct one survey per annum to solicit the building occupants' feedback. The occupants' opinion regarding the waste management plan and the awareness campaigns could serve to make evaluations and improvements.
The occupants' feedback for the past three years, if saved, provides statistical data to improve the annual survey and to keep track of the occupants' engagement rate.
Provide the number of occupants who shared their feedback in the past 3 years.

For Existing Buildings, the Facility shall achieve an additional score based on the level of the occupants' participation. This measures the involvement of the occupants in waste management and reflects the effect of the efforts of the Facility to foster awareness among its occupants.

8.3.3.5 Special Requirements

None

8.3.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.3.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Waste Management Awareness Campaigns	• Outline of Awareness Campaigns elements ○ The Mission Statement ○ The Awareness Campaign Plans ○ The Awareness Activities
5-year Budget Plan for Awareness Campaigns	• The five-year plan for waste management awareness campaigns should enclose a list of the planned events, and the total budget per annum.
Outline of Questionnaires for Water Conservation	• An outline of the questionnaires which solicit the occupants' feedback regarding current waste management measures, challenges and opportunities should be provided.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Waste Management Awareness Campaigns	• The Agendas of Awareness Campaigns should indicate the following elements: ○ The Mission Statement ○ The Awareness Campaign Plans ○ The Awareness Activities
Attendance Sheets of Waste Management Awareness Campaigns	• The Attendance sheets of the Waste Management Awareness Campaigns should list all the managers and all the members of the maintenance team, who attended and when.
The Facility Organization Chart	• The Organization Chart of the Facility or of the Owners' Association should be submitted.
Documented Incentive System	• The document, which describes the incentive system, should be included.
Five-year Budget Plan for Awareness Campaigns	• The five-year plan for waste management awareness campaigns should enclose a list of the planned events, and the total budget per annum.

Submittal Name	Submittal Description
Outline of Questionnaires for Waste Management	- An outline of the questionnaires, which solicit the occupants' feedback on the current waste management measures, challenges and opportunities, should be provided.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Waste Management Awareness Campaigns	- The Agendas of Awareness Campaigns should indicate the following elements: ○ The Mission Statement ○ The Awareness Campaign Plans ○ The Awareness Activities
Attendance Sheets of Waste Management Awareness Campaigns	- The Attendance Sheets of the Waste Management Awareness Campaigns should list all the managers and all the members of the maintenance team, who attended and when.
The Facility Organization Chart	- The Organization Chart of the Facility or of the Owners' Association should be submitted.
Documented Incentive System	- The document, which describes the incentive system, should be included.
List of Recognized Occupants	- The List of occupants who were recognized for their successes in waste management in the past three years.
Five -year Budget Plan for Awareness Campaigns	- The five-year plan for waste management awareness campaigns should enclose a list of the planned events, and the total budget per annum.
Expenditures on Awareness Campaigns for Three Consecutive Years	- The expenditures on Environmental Protection Awareness Campaigns for three consecutive years should be submitted.
Outline of Questionnaires for Waste Management	- An outline of the questionnaires, which solicit the occupants' feedback on the current waste management measures, challenges and opportunities, should be provided.
Occupant Feedback	- Copies of the occupants' feedback to the questionnaires and other suggestions regarding waste management for the past three years.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for certification the reviewers to consider.

8.3.3.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 8.3.3-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Carry out Awareness Campaigns for Waste Management. Recommended Objectives:				
Are the Waste Management Policies (3Rs of Waste Management) well-communicated to all occupants through gatherings or workshops?	1	Yes / No	0 / 0	1
Are informative e-mails, banners, or labels circulated / posted in the Facility?	2	Yes / No	1 / 0	1
Is there an implemented system, which captures and rewards the occupants' successes to preserve their engagement?	3	Yes / No	1 / 0	5
Awareness Budget				
Does the Facility allocate a budget for awareness campaigns?	4	Yes / No	1 / 0	5
Occupant Feedback				
Does the Facility solicit the occupants' feedback on the ways to reduce waste?	5	Yes / No	1 / 0	5

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
What is the average number of occupants who shared their feedback over the past 3 years?	6	V_6	F_6	3
Total No of occupants	7	V_7		

F_6 is calculated using the following formula:

$$F_6 = \left(\frac{V_6}{V_7}\right) * 2$$

Where

V_6 is the average number of occupants who shared their feedback over the past 3 years .

$$V_6 = \left(\frac{\sum_{i=1}^{3} Number\ Of\ Occuapnts\ who\ shared\ feedback_{Year\ i}}{3}\right)$$

V_7 is the total number of occupants at the Facility

F_6 Maximum value is 1

In order to determine the criterion score, the following formula is applied:

New Building

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{5}(F_i * WF_i)}{\sum_{i=1}^{5} WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

Existing Building

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{6}(F_i * WF_i)}{\sum_{i=1}^{6} WF_i}\right]$$

A project earns a score of a 100% by complying with each of the aforementioned requirements along with a minimum of 50% of the occupants sharing their feedback on average over the past three years.

8.3.4 Ma-3.4: Sustainable Purchasing

8.3.4.1 Criterion Reference and Title

Ma-3.4 Sustainable Purchasing

8.3.4.2 Criterion Type

Optional

8.3.4.3 Intent

To reduce the environmental harm of materials and consumables which are purchased during the lifecycle of a Facility.

8.3.4.4 General Requirements

Develop a policy for Sustainable Purchases of the ongoing consumables for the operational needs of the Facility. The Policy statement shall require the purchase of environmentally preferred products, which have no impact on human health, and which are the least harmful to the environment. The Policy shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner’s Association signatory (Residential Sector).

The Policy shall have the following sections or attachments:

Mission Statement

Develop a Mission Statement, which includes/states measurable targets related to the sustainable purchasing of materials and consumables.

Nominated Champion

The Facility shall have a nominated champion for the sourcing and validation of the sustainable materials and consumables.

- The champion is either an employee of the Facility, a resident of the Facility (Residential Sector) or otherwise subcontracted. He should report to the head of the Applicant’s Organization or the Owners’ Association (Residential Sector).
- He can be either a dedicated manager or officer, or a staff member who takes on this role in addition to other roles in the Facility.
- The job requirements should include the following minimum tasks:
    - Enforce the policy for sustainable purchasing.

    - Create purchasing standards and a sustainable purchasing best practices manual.
    - Conduct pilot testing of new materials.
    - Assess the market availability of sustainable goods.
- The Champion shall be a qualified individual or entity, who is certified from an industry recognized certification body in sustainability, environmental health and safety, or in Facility management, with a minimum of 6 years of experience.

The policy shall require one or more of the following items:

- Paper products (e.g., paper towel, toilet paper, etc.) made from recycled materials
- Office supplies (e.g., writing pads, pens, ink cartridges…) made from recycled materials
- Environmentally-safe cleaning supplies
- Biodegradable trash bags
- Certified Volatile Organic Compound (VOC) free paint
- Certified VOC free adhesives
- Furniture made with at least 50% recycled content
- Fabric made from recycled materials
- Certified green appliances.

Demonstrate for each of the aforementioned categories of consumables that at least 50% (by value) of the purchases comply with the purchasing policy.

New Building
Make a commitment to submit necessary records for three consecutive years, starting no later than the date of applying for certification.

Existing Building
Provide necessary records for three consecutive years, which could be either pre or post certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive. In case of a post-certification record submittal, a prior binding commitment is required.

8.3.4.5 Special Requirements

None

8.3.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.3.4-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Policy for Sustainable Purchasing	• A simple outline of the Sustainable Procurement Policy should include one or more of the following: ○ The Mission Statement ○ The Sustainable Procurement Manual ○ The job description of the Sustainable Procurement Champion.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Policy for Sustainable Purchasing	• The Policy for Sustainable Purchasing should include one or more of the following: ○ The Mission Statement ○ The Sustainable Procurement Manual ○ The job description of the Sustainable Procurement Champion. • The Policy for Sustainable Purchasing should indicate which categories of consumables are regulated by this policy.
Name and Qualifications of the Champion	• The Name and The Qualifications of the Sustainable Procurement Champion should be provided.
Purchases	• For each category, demonstrate that at least 50% (by value) of the purchases made comply with the purchasing policy. A prior binding commitment to provide the KPIs for the three consecutive post-certification years is required.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
Policy for Sustainable Purchasing	• The Policy for Sustainable Purchasing should include one or more of the following: ○ The Mission Statement ○ The Sustainable Procurement Manual ○ The job description of the Sustainable Procurement Champion. • The Policy for Sustainable Purchasing should indicate which categories of consumables are regulated by this policy.
Name and Qualifications of the Champion	• The Name and The Qualifications of the Sustainable Procurement Champion should be provided.
Purchases	• For each Category, demonstrate that at least 50% (by value) of the purchases made comply with the purchasing policy. A prior binding commitment to provide the KPIs for the balance of the required three consecutive years is necessary.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.3.4.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 8.3.4-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Commitment				
Does the Facility have a Sustainable Purchasing Policy?	1	Yes / No	0 / 0	1
Does the Policy include a Mission Statement with targets to be met?	2	Yes / No	1 / 0	1
Does the Policy require a nominated Champion?	3	Yes / No	1 / 0	1

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Scope				
Does the Facility's purchasing activities require sustainable products for the following items?		Yes / No	1 / 0	
Paper products (e.g., paper towel, toilet paper, etc.)	4	Yes / No	1 / 0	1
Office supplies (e.g., writing pads, pens, etc.)	5	Yes / No	1 / 0	1
Cleaning supplies	6	Yes / No	1 / 0	1
Biodegradable trash bags	7	Yes / No	1 / 0	1
Paint	8	Yes / No	1 / 0	1
Adhesives	9	Yes / No	1 / 0	1
Furniture	10	Yes / No	1 / 0	1
Fabric	11	Yes / No	1 / 0	1
Certified green appliances	12	Yes / No	1 / 0	2

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{12}(F_i * WF_i)}{\sum_{i=1}^{12} WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

8.3.5 Ma-3.5: Hazardous Waste

8.3.5.1 Criterion Reference and Title

Ma-3.5: Hazardous Waste

8.3.5.2 Criterion Type

Optional

8.3.5.3 Intent

To reduce the environmental burden on communities and ecosystems by reducing the waste disposed in landfills. To eliminate the health and safety risks associated with the handling and disposal of hazardous waste.

8.3.5.4 General Requirements

The characteristics of hazardous waste are ignitability, corrosivity, reactivity, and/or toxicity.

Develop a Hazardous Waste Policy or a Waste Management Policy, which demonstrates the top management commitment to the reduction, and the proper collection, storage and disposal of hazardous waste, which is generated by the Facility during its operation. The Policy shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner's Association signatory (Residential Sector).

The Hazardous Waste or Waste Management Policy shall

- Include in the Mission Statement the commitment of the top management to reduce, properly collect, store, and dispose of hazardous waste
- Require the Applicant to
    - Have a Hazardous Waste or Waste Management Plan
    - Address training among all occupants
    - Designate a Hazardous Waste or Waste Management Champion in charge of implementing a Hazardous Waste Management Plan
    - Require the measurement of Key Performance Indicators (KPIs) to evaluate and validate the achievement of the desired targets.

The Policy shall have the following sections or attachments:

Waste Management Plan

Develop a Hazardous Waste Management Plan honoring the intent of this criterion and including training campaigns, evaluation of performance, and improvements.

For the purpose of this criterion, the Hazardous Waste Management Plan shall, at a minimum,

- Identify the different hazardous waste streams at the facility
- Identify reduction methodologies
- Identify required waste segregation to prevent fires, explosions, or the generation of toxic fumes due to cross contamination
- Identify applicable storage containers for various streams
- Identify storage areas for all waste streams as categorized in the Waste Management Plan and identify requirements to access these storage areas
- Fully document the above to demonstrate the proper identification, collection, storage, and disposal of hazardous waste.

Mission Statement

Develop a Mission Statement, which includes/states measurable initiatives to demonstrate a commitment to reduce, segregate, properly store and dispose of the various types of hazardous waste, which is generated by the Facility.

Nominated Recycling or Waste Management Champion

The Facility shall have a nominated Hazardous Waste Management or Waste Management Champion to implement the Waste Management Plan and its initiatives.

- The champion is either an employee of the Facility, a resident of the Facility (Residential Sector), or otherwise subcontracted. He should report to the head of the Applicant’s Organization or the Owners’ Association (Residential Sector).
- He can either be a dedicated manager or officer, or a staff member who takes on this role in addition to other roles in the Facility.
- The job requirements should include the following minimum tasks:
  - Enforce the Waste Management Policy
  - Raise Awareness
  - Measure KPIs and achieve the recycling targets
  - Ensure the Applicant’s initiatives are executed as indicated in the Mission Statement.
- The Champion shall be a qualified individual or entity, who is certified from an industry recognized certification body in sustainability, environmental health and safety, or in Facility management, with a minimum of 6 years of experience.

Measurement of KPIs

The Facility shall have a methodology to monitor the generation, segregation, storage and disposal of hazardous waste per waste stream.
Demonstrate the effectiveness of the Waste Management Plan in hazardous waste reduction, segregation, storage, and disposal by applying the KPIs. Enclose a list of the hazardous waste incidents and accidents, which had occurred, and specify the corrective measures, which were taken. Demonstrate the above as follows:

New Building
Make a commitment to submit the necessary records for three consecutive years, starting no later than the date of applying for certification.

Existing Building
Provide necessary records for three consecutive years, which could be either pre or post certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive. In case of a post-certification record submittal, a prior binding commitment is required.

Comply with the following additional requirements:

Dedicated Hazardous Waste Storage Areas
Provide dedicated spaces for the collection and storage of hazardous materials for the entire building.

Demonstrate that both the construction and the location of the dedicated spaces are suitable for storing hazardous materials.

The Applicant shall properly segregate and dispose of the hazardous waste according to the applicable laws (i.e., either internally under a license or via licensed third parties).
This space shall be accessible to building occupants and waste transporters, and shall ensure the safe collection, storage and disposal of the following:

- Batteries
- Electronics
- CDs and DVDs
- Cooking oil
- Equipment lubricants
- Refrigerants
- Tires

- Automotive batteries
- Asbestos Containing Material (ACM).

Because of high environmental concern about the aforementioned waste materials, the Applicant shall provide a comprehensive Hazardous Waste Management Plan/Policy, in which he /she shall identify how and where this waste will be processed and diverted. The Mission Statement shall clearly identify the targets to be met.
The Hazardous Waste Management Plan shall demonstrate the extra precautionary measures applied in order to prevent breakage or exposure to toxins emanating from the specialized waste streams. It is also required to provide a memorandum of understanding with hazardous waste transportation and disposal facilities.

8.3.5.5 Special Requirements

For hospitals and educational facilities, provide the Hazardous Waste Management Plan for the following additional waste streams:

- Medical Waste
- Radioactive Waste
- Toxic Waste.

8.3.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.3.5-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Floor Plans Showing the Hazardous Waste Collection Areas	• The Floor Plans shall indicate ○ The type of hazardous waste per space ○ The construction of the space, its location, and its distance from other hazards and occupied areas as per applicable standards ○ The size of the space dedicated for the hazardous-waste stream ○ The accessibility of the hazardous-waste collection area.

Submittal Name	Submittal Description
Hazardous Management Policy	• A simple outline of the Hazardous Waste or Waste Management Policy should include one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The measurement of KPIs ○ The job description of the Waste Reduction or Waste Management Champion.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Floor Plans and Photos Showing the Hazardous Waste Collection Areas	• The Floor Plans shall indicate ○ The type of hazardous waste per space ○ The construction of the space, its location, and its distance from other hazards and occupied areas as per applicable standards ○ The size of the space dedicated for the hazardous-waste stream ○ The accessibility of the hazardous-waste collection area.
Hazardous Management Policy	• The Hazardous Waste or Waste Management Policy should include one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The measurement of KPIs ○ The job description of the Waste Reduction or Waste Management Champion.
Name and Qualifications of the Hazardous Waste Management Champion	• The name and the qualifications of the Hazardous-Waste Management Champion should be provided.
Evaluation Reports of Hazardous-Waste KPIs	• The Evaluation Reports of the hazardous-waste KPIs should indicate the value of the KPIs, the frequency, and the result of the evaluation. A prior binding commitment is required if the submitted KPIs are for the three consecutive post-certification years.
Memoranda of Understanding (MOUs)	• The Applicant should provide copies of the MOUs, which are in place with licensed third parties for the proper disposal of hazardous waste.

Submittal Name	Submittal Description
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Floor Plans and Photos Showing the Hazardous Waste Collection Areas	• The Floor Plans shall indicate ○ The type of hazardous waste per space ○ The construction of the space, its location, and its distance from other hazards and occupied areas as per applicable standards ○ The size of the space dedicated for the hazardous-waste stream ○ The accessibility of the hazardous-waste collection area.
Hazardous Management Policy	• The Hazardous Waste or Waste Management Policy should include one or more of the following: ○ The Mission Statement ○ The Waste Management Plan ○ The measurement of KPIs ○ The job description of the Waste Reduction or Waste Management Champion.
Evaluation Reports of Targets	• The Evaluation Reports of the status of the targets indicated in the Mission Statement should include the measures taken and what percentage is achieved per target.
Evaluation Reports of Hazardous-Waste KPIs	• The Evaluation Reports of the hazardous-waste KPIs should indicate the value of the KPIs, the frequency, and the result of the evaluation. A prior binding commitment to provide the KPIs for the balance of the required three consecutive years is necessary.
Name and Qualifications of the Hazardous Waste Management Champion	• The name and the qualifications of the Hazardous-Waste Management Champion should be provided.
Management Plan for the Processing of Each Hazardous Waste Stream	• For each of the mentioned hazardous streams, indicate the path for waste processing and safe waste storage.
Memoranda of Understanding (MOUs)	• The Applicant should provide copies of the MOUs, which are in place with licensed third parties for the proper disposal of hazardous waste.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.3.5.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Each of the mentioned parameters hereunder will grant the applicant a certain percentage depending on the weight of each parameter.

Table 8.3.5-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
I. Commitment				
Does the Facility have a Hazardous Waste Policy?	1	Yes / No	1 / 0	2
Does the Policy include a Mission Statement with targets to be met?	2	Yes / No	1 / 0	2
Does the Policy require a nominated Champion?	3	Yes / No	1 / 0	5
II. Does the Facility have contracts or nominated service providers for the following?				
Batteries	4	Yes / No	1 / 0	1
Electronics	5	Yes / No	1 / 0	1
CDs and DVDs	6	Yes / No	1 / 0	1
Cooking oil	7	Yes / No	1 / 0	1
Equipment lubricants	8	Yes / No	1 / 0	1
Refrigerants	9	Yes / No	1 / 0	1
Tires	10	Yes / No	1 / 0	1
Automotive batteries	11	Yes / No	1 / 0	1
Medical waste	12	Yes / No	1 / 0	1
Radioactive waste	13	Yes / No	1 / 0	1

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Toxic waste	14	Yes / No	1 / 0	1
Asbestos Containing Material (ACM)	15	Yes / No	1 / 0	1

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{15}(F_i * WF_i)}{\sum_{i=1}^{15} WF_i}\right]$$

8.4 Family: Bonus

8.4.1 Ma-4.1: Life Cycle Assessment

8.4.1.1 Criterion Reference and Title

Ma-4.1: Life Cycle Assessment

8.4.1.2 Criterion Type

Optional

8.4.1.3 Intent

To assess the environmental impact of the construction and operation of the building by conducting a building Life Cycle Assessment (LCA).

8.4.1.4 General Requirements

A Life Cycle Assessment (LCA) is an analysis method used to assess the environmental impact associated with a product over its whole life cycle, which typically consists of five stages (Cradle to Grave):

1) Raw material extraction
2) Manufacturing and processing
3) Transportation
4) Use
5) Disposal (End of Life).

A Life Cycle Assessment (LCA) can be used to

- Compare the environmental impacts of the life cycle of various products
- Assess the environmental impact at various stages during the life cycle of a product in order to prioritize improvements and minimize the associated effects.

There are several indicators, which can be considered when conducting an LCA. The table hereunder includes the typical indicators:

Life Cycle Assessment Impact Indicators		
No.	**Environmental Impact Indicator**	**Unit of Measurement**
1	Global Warming Potential	Kg CO_2e
2	Acidification Potential	Kg SO_2e
3	Eutrophication Potential	Kg PO_4e
4	Stratospheric Ozone Depletion Potential	Kg $CFC_{11}e$

5	Photochemical Ozone Creation Potential	Kg C_2H_4 e
6	Waste Processing	kg

Global Warming Potential

Global Warming Potential (GWP) refers to the contribution of a product to the greenhouse effect. It is based on the heat-absorbing ability of each gas relative to that of carbon dioxide (CO_2). It is measured in kilogram (kg) CO_2-equivalent.

Acidification Potential

Acidification refers to the increase in hydrogen ions (H+) deposited in a receiving medium. This alters the potential hydrogen (pH) of that medium, which may cause damage to the organic and inorganic materials contained therein. Acidification is measured in kilogram (kg) SO_2-equivalent.

Eutrophication Potential

Eutrophication refers to the increase of nutrients in the water or the soil causing excessive biomass growth and decay, the result of which is oxygen depletion. Eutrophication is measured in kilogram (kg) PO_4-equivalent.

Stratospheric Ozone Depletion Potential

The earth is protected by a layer of stratospheric ozone (O_3), which decreases the amount of ultraviolet radiation reaching the earth's surface. High ultraviolet radiation can have detrimental effects, namely a reduction in biological productivity, a damage to building materials, an increased risk of skin cancer, and other health problems. Stratospheric Ozone Depletion is measured in kilogram (kg) CFC_{11}-equivalent.

Photochemical Ozone Creation Potential

Photochemical oxidation, also known as summer smog, is caused by the reaction of sunlight with pollutant emissions (volatile organic compounds and nitrogen oxides) creating other harmful chemicals (Ozone). Photochemical Ozone Creation is measured in kilogram (kg) Ethylene-equivalent.

Waste Processing

Waste processing refers to the amount of solid waste generated over the life cycle of the building. It is measured in kilogram (kg).

The building components covered by the Life Cycle Assessment for this criterion are seven and should include:

1) Construction materials
2) Transportation to site
3) Construction / Installation process
4) Maintenance and material replacement
5) Energy use

6) Water use
7) Deconstruction.

The score for this criterion is determined based on the number of building components included in the life cycle assessment of the project and all the environmental impact indicators.

8.4.1.5 Special Requirements

None

8.4.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.4.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Building Life Cycle Assessment Report during Design	• The Building Life Cycle Assessment Report during the Design phase should include the specified building components and the assessment of all the environmental impact indicators related to each component.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Life Cycle Assessment Report of As-built Building	• The Life Cycle Assessment Report of the building under construction should include the installed building components and the assessment of all the environmental impact indicators related to each component.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Life Cycle Assessment Report of As-built Building	• The Life Cycle Assessment Report of the existing building should include the installed building components and the assessment of all the environmental impact indicators related to each component.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting

documents, which can provide additional relevant information for the certification reviewers to consider.

8.4.1.7 Score Allocation

The score for this criterion is determined based on the number of building components included in the Life Cycle Assessment (LCA) of the project. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * F_2$$

Where:

- F_1 is calculated using the following formula:
  If the project provided a life cycle assessment report, $F_1 = 1$
  If the project did not provide a life cycle assessment report, $F_1 = 0$
- F_2 is calculated using the following formula:
  $$F_2 = \frac{Number\ of\ Building\ Components\ included\ in\ LCA}{7}$$

A project earns a score of 100% for this criterion by providing a Building Life Cycle Assessment Report of all seven building components included.

8.4.2 Ma-4.2: Waste Audit

8.4.2.1 Criterion Reference and Title

Ma-4.2: Waste Audit

8.4.2.2 Criterion Type

Optional

8.4.2.3 Intent

To reduce the waste materials sent to landfills by conducting a waste audit to identify main waste streams and develop an action plan for waste diversion.

8.4.2.4 General Requirements

A waste audit is a survey of the building's waste streams in order to explore the potential for waste reduction or diversion. The steps involved in a typical waste audit come as follows:

1) Building the audit team
2) Defining the plan and the objectives
3) Scheduling the audit
4) Providing the tools and the equipment
5) Organizing and sorting the materials
6) Analyzing the results
7) Developing an action plan.

1) Building the Audit Team

Establish an audit team from the building occupants, who are familiar with building operations. Discuss with them the waste audit procedure and agree on the roles and responsibilities of each member. The size of the team will depend on the size of the Facility. Team leaders should be assigned to cover different areas.

2) Defining the Plan and the Objectives

Pre-audit planning is essential for the success of the audit. Determining the who, the how, and the why is very important to align the goals of the whole team. Define the scope and ensure that all the tasks will be performed properly.

3) Scheduling the Audit

To avoid non-representative results, select a date for the actual on-the-ground works to ensure that the audit is going to assess the normal waste output of the building and not the output of some special or occasional event.

4) Providing the Tools and the Equipment

To conduct the audit works safely, the workers should sort items in an open well-ventilated area using the following tools and equipment:

- Rubber gloves
- Face masks
- Collection bags
- Tongs
- Labeled boxes for sorting waste streams
- A scale for weighing each waste stream

5) Organizing and Sorting the Materials

The actual on-the-ground works involve the following tasks:

- Gathering all building waste in an open area
- Weighing all the trash to set the baseline
- Sorting all the materials into various waste streams using labeled boxes
- Weighing each waste stream and identifying recyclable and non-recyclable materials
- Noting down the results

6) Analyzing the Results

Based on the results of waste stream sorting, the following can be determined:

- The percentage of recyclable materials
- The rate of diversion
- The non-recyclable waste
- The organic waste.

These results will be used to develop the action plan for waste reduction and diversion in the building.

7) Developing an Action Plan

The action plan should be developed based on the aforementioned findings, and should include the required seven steps to achieve the objectives of the audit. The results of the waste audit should be shared with all the building occupants in an attempt to increase their awareness and to spur them to adopt the recycling goals.

The project should implement all the waste audit steps listed in the table hereunder in order to earn a score on this criterion:

Waste Audit Plan Steps		
No.	**Waste Audit Steps**	**Required**
1	Building the waste audit team	Yes
2	Defining the plan and the objectives of the waste audit	Yes
3	Scheduling the waste audit	Yes
4	Providing the tools and the equipment for the waste audit	Yes
5	Organizing and sorting the materials into various waste streams	Yes
6	Analyzing the results of the waste audit	Yes
7	Developing an action plan	Yes

8.4.2.5 Special Requirements

None

8.4.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.4.2-1. Required Submittals

Submittal Name	**Submittal Description**
New Building in Design Phase	
N/A	•
New Building in Construction Phase	
N/A	•
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Waste Audit Action Plan	• As part of the waste audit, the action plan should describe all the steps to be implemented.
Results Report	• The results of the waste audit should be documented in a final report including the proposed action plan.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting

documents, which can provide additional relevant information for the certification reviewers to consider.

8.4.2.7 Score Allocation

The score for this criterion is determined based on the compliance with all the waste audit steps. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * F_2$$

Where:

- F_1 is calculated using the following formula:

  If the project provided a waste audit plan, $F_1 = 1$
  If the project did not provide a waste audit plan, $F_1 = 0$
- F_2 is calculated using the following formula:

  If all the required waste audit steps are included in the waste audit plan, $F_2 = 1$
  If one or more required waste audit steps were not included in waste audit plan, $F_2 = 0$

A project earns a score of 100% for this criterion by developing and implementing a waste audit plan including all the steps described in the criterion requirements.

8.4.3 Ma-4.3: Innovation

8.4.3.1 Criterion Reference and Title

Ma-4.3: Innovation

8.4.3.2 Criterion Type

Optional

8.4.3.3 Intent

To support innovation and new solutions for the smart use of resources, which are not rewarded by standard ARZ criteria and which lead to a reduction in the overall impact of materials on the environment.

8.4.3.4 General Requirements

Demonstrate any new smart solution, technology, invention, design, construction, operation, maintenance or demolition method or process, which is not covered in ARZ 2.0, and which proves to be effective in terms of efficiency of the resources and safety to the environment. The innovation must be approved by LGBC as an integrated part of the submitted application form. The innovation must be significant, achievable and measurable by identifying the following:

- The intent of the proposed innovation criterion
- The proposed general and special requirements for compliance
- The proposed required submittals to demonstrate compliance

Up to a maximum of 5 innovation items are available in aggregate from a combination of the following:

1) Approved Innovation

One or several items can be awarded for each innovation application form approved by LGBC after the submittal review process.

2) Exemplary level of performance according to ARZ criteria in the Materials module

The project demonstrates exemplary performance if one or more of the following ARZ assessment criteria are met at an exemplary level of performance:

- Ma-2.2 Recycled Materials
- Ma-2.3 Material Environmental Impact
- Ma-2.5 Materials’ Reuse

- Ma-3.1 Recycling
- Ma-3.2 Waste Reduction
- Ma-3.4 Sustainable Purchasing

8.4.3.5 Special Requirements

None

8.4.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 8.4.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• Submit drawings for the proposed innovation or exemplary performance (if available)
Specifications	• Submit an extract of the specifications of the proposed innovation or exemplary performance (if available)
New Building in Construction Phase	
Criterion Narrative	• Updated criterion narrative (if different from Design Phase)
As-Built Drawings	• Submit As-built drawings for the proposed innovation or exemplary performance (if available).
Manufacturer Datasheets	• Submit Manufacturer datasheets / catalogs for the proposed innovation or exemplary performance (if available).
Guideline	• Provide a documentation guideline how the proposed innovation materializes.
Existing Building	
Criterion Narrative	• Criterion narrative should give a brief description of the strategy implemented by the project team to meet this criterion's requirements.
As-Built Drawings	• Submit As-built drawings for the proposed innovation or exemplary performance (if available).
Manufacturer Datasheets	• Submit Manufacturer datasheets / catalogs for the proposed innovation or exemplary performance (if available).

Submittal Name	Submittal Description
Guideline	• Provide a documentation guideline how the proposed innovation materializes.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

8.4.3.7 Score Allocation

The score for the innovation criterion is determined based on the innovation or exemplary performance achieved. The weight factor will be set once the ARZ review committee members assess the originality and performance of the submitted innovation.

Table 8.4.3-2. Weight Factor for Each Criterion Requirement

Parameters Requirements	Weight Factor “WF”	
Innovation Feature-1	$\boldsymbol{WF_1}$	58
Innovation Feature-2	$\boldsymbol{WF_2}$	10
Innovation Feature-3	$\boldsymbol{WF_3}$	10
Innovation Feature-4	$\boldsymbol{WF_4}$	10
Innovation Feature-5	$\boldsymbol{WF_5}$	10

The calculator will determine a preliminary score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{5}(F_i * WF_i)}{\sum_{i=1}^{5} WF_i}\right]$$

Where:

- F_i is calculated using the following formula:
  If the submitted project includes Innovation Feature, F_i=1
  If the submitted project does not include Innovation Feature, F_i=0

9. Module: Water

9.1 Family: Water Metering and Control

9.1.1 Wa-1.1: Water Metering

9.1.1.1 Criterion Reference and Title

Wa-1.1: Water Metering

9.1.1.2 Criterion Type

Prerequisite

9.1.1.3 Intent

To boost effective building-level water management and explore opportunities for additional water savings by tracking water consumption, preventing leaks and understanding water use in buildings.

9.1.1.4 General Requirements

A) Water Monitoring

Install permanent water meters, which are easily accessible for reading and maintenance, to measure and record the whole building total potable water consumption from all potable water sources on the site (i.e., public water supply, On-site well, On-site potable water treatment system).

The water metering data must be compiled into monthly and yearly water use summaries and be recorded by the water monitoring system.

B) Water Meter Type and Control

The water meter type can be Digital with a data logger or the smart type. Water meter(s) must be connected to the Building Management System (BMS) of the building, if available.

9.1.1.5 Special Requirements

None

9.1.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.1.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Water Supply Drawings	• The Water Supply Drawings should show all the proposed water meter(s), and the water monitoring and control system components.
Specifications	• The Specifications of all the components of the proposed water meter(s), and the water monitoring and control system components should be provided.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-Built Water Supply Drawings	• The As-built Water Supply Drawings should show all the proposed water meter(s), and the water monitoring and control system components.
Manufacturer Datasheets	• The Manufacturer Datasheets / Catalogs of all the installed water meter(s), and the water monitoring and control system components should be provided.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Water Supply Drawings	• The As-built Water Supply Drawings should show all the proposed water meter(s), and the water monitoring and control system components.
Datasheets	• The Manufacturer Datasheets / Catalogs of all the installed water meter(s), and the water monitoring and control system components should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.1.1.7 Score Allocation

The score for this criterion is determined based on the water monitoring, the water meter type and the control requirements. Note that at least one water meter should be installed for the whole building to make it eligible for this criterion. Factors and weight factors are applied to each requirement as follows:

Table 9.1.1-2. Factors and Weight Factors for Each Requirement Criterion

Parameters Requirements	**Status**	**Factor “F”**		**Weight Factor “WF”**	
Water Monitoring	Yes	$\boldsymbol{F_1}$	1	$\boldsymbol{WF_1}$	5
	No		0		5
Water Meter Control (connection to BMS)	Yes	$\boldsymbol{F_2}$	1	$\boldsymbol{WF_2}$	2
	No		0		2
	N/A		0		0
Water Meter Type	Digital with data logger	$\boldsymbol{F_3}$	1	$\boldsymbol{WF_3}$	2
	Smart		1		3

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \ 100 * F_1 * \left[\frac{(F_1 * WF_1) + (F_2 * WF_2) + (F_3 * WF_3)}{(WF_1 + WF_2 + WF_3) + (3 - WF_3)}\right]$$

If the project does not include any water meter for the whole building, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if a smart water meter is installed and connected to the Building Management System BMS.

9.1.2 Wa-1.2: Water Submetering

9.1.2.1 Criterion Reference and Title

Wa-1.2: Water Submetering

9.1.2.2 Criterion Type

Optional

9.1.2.3 Intent

To boost additional effective water management and explore opportunities for additional water savings by tracking water consumption, prevention of leaks and understanding water use in buildings.

9.1.2.4 General Requirements

A) Water Monitoring

Install permanent labeled water submeter(s), which are easily accessible for reading and maintenance, to measure and record the water consumption for the following major uses (at a minimum, where present):

- Bathroom/Toilet Facilities/Showers
- Kitchenette/Kitchen/Catering Facilities
- Laundry Facilities
- Domestic Hot Water System
- Irrigation
- Swimming Pools
- Water Features
- Reclaimed water.

The water submetering data must be compiled into monthly and yearly water use summaries and must be recorded by the water monitoring system.

B) Water Submeter Type and Control

The water submeter type can be Digital with a data logger or the smart type. The water submeter(s) can be connected to the Building Management System (BMS) of the building, if available.

9.1.2.5 Special Requirements

For Healthcare Projects only

In addition to the aforementioned requirements, install water submeters for any of the following:

- Laboratories
- Surgical Suites
- Treatment Areas (Physiotherapy and Hydrotherapy)
- Dietary Departments
- Sterile Processing Departments
- Pharmaceutical Purified Water Systems
- Hydronic Makeup Water systems

For the Tenant Area in All Building Sectors

The tenant area, which must be independently sub-metered for water consumption, must be equipped with a sufficient number of meters for that end. The building owner/developer should commit in writing to have water submetering requirements for the tenant areas as per the building sector. This commitment means that future owners and tenants shall implement water submetering as stated in the Contracts of Sale and the Rent Agreements.

9.1.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.1.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Water Supply Drawings	• The Water Supply Drawings should show all the proposed water submeter(s), and the water monitoring and control system components.
Specifications	• The Specifications of all the components of the proposed water submeter(s), and the water monitoring and control system components should be provided.
Written Commitment	• A written commitment should be made by the building owner/developer that future owners and tenants shall

Submittal Name	Submittal Description
	implement water submetering as stated in the Contracts of Sale and the Rent Agreements.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from Design Phase)
As-Built Water Supply Drawings	• The As-built Water Supply Drawings should show all the proposed water submeter(s), and the water monitoring and control system components.
Manufacturer Datasheets	• The Manufacturer Datasheets / Catalogs for all the installed water submeter(s), and the water monitoring and control system components should be provided.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Water Supply Drawings	• The As-built Water Supply Drawings should show all the proposed water submeter(s), and the central water monitoring and control system components.
Manufacturer Datasheets	• The Manufacturer Datasheets / Catalogs for all the installed water submeter(s) and the central water monitoring system should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.1.2.7 Score Allocation

The score for this criterion is determined based on three elements: (1) the water monitoring, (2) the water submeter type and (3) the control requirements. Note that at least one water submeter should be installed in order to qualify for this criterion. Factors and weight factors are applied to each requirement for each building sector as follows:

OFFICE

Table 9.1.2-2. Factors and Weight Factors of Each Criterion Requirement for Office Sector

	Parameters Requirements		Status	Factor "F"		Weight Factor "WF"	
OFFICE	**Water Monitoring**	Toilet	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Kitchenette	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
		Shower	Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		Domestic Hot Water System	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
		Irrigation	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
		Water Features	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		Reclaimed water	Yes	F_7	1	WF_7	1
			No		0		1
			N/A		0		0
	Water submeter Control (connected to BMS)		Yes	F_8	1	WF_8	2
			No		0		2
			N/A		0		0
	Water Submeter Type		Digital with Data Logger	F_9	1	WF_9	2
			Smart		1		3

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{9} F_i * WF_i)}{(\sum_{i=1}^{9} WF_i) + (3 - WF_9)}\right]$$

Where:

F_0 is calculated using the following formula:
If the project includes at least one energy submeter ($\sum_{i=1}^{7} F_i \neq 0$) , F_0 = 1
If the project does not include any energy submeter ($\sum_{i=1}^{7} F_i = 0$) , F_0 = 0

If the project does not include any water submeter, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the smart water submeters for all major water uses cited above are installed and connected to the Building Management System (BMS).

MALL

Table 9.1.2-3. Factors and Weight Factors of Each Criterion Requirement for the Mall Sector

	Parameters Requirements		Status	Factor "F"		Weight Factor "WF"	
MALL	**Water Monitoring**	Toilet Facilities	Yes	F_1	1	WF_1	3
			No		0		3
			N/A		0		0
		Shower Facilities	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
		Catering Facilities	Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		Laundry Facilities	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
		Domestic Hot Water System	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
		Irrigation	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		Water Features	Yes	F_7	1	WF_7	1
			No		0		1
			N/A		0		0
		Reclaimed Water	Yes	F_8	1	WF_8	1
			No		0		1
			N/A		0		0
			Yes	F_9	1	WF_9	2

	Water Submeter Control (connected to BMS)	No		0		2
		N/A		0		0
	Water Submeter Type	Digital with Data Logger	$\boldsymbol{F_{10}}$	1	$\boldsymbol{WF_{10}}$	2
		Smart		1		3

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{\left(\sum_{i=1}^{10} F_i * WF_i\right)}{\left(\sum_{i=1}^{10} WF_i\right) + (3 - WF_{10})}\right]$$

Where:

F_0 is calculated using the following formula:

If project includes at least one energy submeter ($\sum_{i=1}^{8} F_i \neq 0$) , F_0 = 1

If project does not include any energy submeter ($\sum_{i=1}^{8} F_i = 0$) , F_0 = 0

If the project does not include any water submeter, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the smart water submeters for all the major water uses cited above are installed and connected to the Building Management System (BMS).

HOTEL

Table 9.1.2-4. Factors and Weight Factors of Each Criterion Requirement for the Hotel Sector

	Parameters Requirements		**Status**	**Factor "F"**		**Weight Factor "WF"**	
HOTEL	**Water Monitoring**	Guest Bathrooms with Pantries If Present	Yes	$\boldsymbol{F_1}$	1	$\boldsymbol{WF_1}$	3
			No		0		3
			N/A		0		0
		Public Shower Facilities	Yes	$\boldsymbol{F_2}$	1	$\boldsymbol{WF_2}$	1
			No		0		1
			N/A		0		0
		Public Toilet Facilities	Yes	$\boldsymbol{F_3}$	1	$\boldsymbol{WF_3}$	1
			No		0		1
			N/A		0		0
		Catering Facilities	Yes	$\boldsymbol{F_4}$	1	$\boldsymbol{WF_4}$	1
			No		0		1

			N/A		0		0
		Laundry Facilities	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
		Domestic Hot Water System	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		Irrigation	Yes	F_7	1	WF_7	1
			No		0		1
			N/A		0		0
		Swimming Pools	Yes	F_8	1	WF_8	1
			No		0		1
			N/A		0		0
		Water Features	Yes	F_9	1	WF_9	1
			No		0		1
			N/A		0		0
		Reclaimed Water	Yes	F_{10}	1	WF_{10}	1
			No		0		1
			N/A		0		0
	Water Submeter Control (Connected To BMS)		Yes	F_{11}	1	WF_{11}	2
			No		0		2
			N/A		0		0
	Water Submeter Type		Digital with Data Logger	F_{12}	1	WF_{12}	2
			Smart		1		3

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{12} F_i * WF_i)}{(\sum_{i=1}^{12} WF_i) + (3 - WF_{12})}\right]$$

Where:

F_0 is calculated using the following formula:

If the project includes at least one energy submeter $(\sum_{i=1}^{10} F_i \neq 0)$, $F_0 = 1$

If the project does not include any energy submeter $(\sum_{i=1}^{10} F_i = 0)$, $F_0 = 0$

If the project does not include any water submeter, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the smart water submeters for all the major water uses cited above are installed and connected to the Building Management System (BMS).

EDUCATIONAL FACILITIES

Table 9.1.2-5. Factors and Weight Factors of Each Criterion Requirement for the Educational Sector

	Parameters Requirements		Status	Factor "F"		Weight Factor "WF"	
EDUCATIONAL FACILITIES	**Water Monitoring**	Toilet Facilities	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Shower Facilities	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
		Domestic Hot Water System	Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		Irrigation	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
		Swimming Pool	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
		Reclaimed Water	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
	Water Submeter Control (Connected To BMS)		Yes	F_7	1	WF_7	2
			No		0		2
			N/A		0		0
	Water Submeter Type		Digital with data logger	F_8	1	WF_8	2
			Smart		1		3

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{\left(\sum_{i=1}^{8} F_i * WF_i\right)}{\left(\sum_{i=1}^{8} WF_i\right) + (3 - WF_8)}\right]$$

Where:

F_0 is calculated using the following formula:

If project includes at least one energy submeter ($\sum_{i=1}^{6} F_i \neq 0$) , $F_0 = 1$

If project does not include any energy submeter ($\sum_{i=1}^{6} F_i = 0$) , $F_0 = 0$

If the project does not include any water submeter, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the smart water submeters for all the major water uses cited above are installed and connected to the Building Management System (BMS).

HOSPITAL

Table 9.1.2-6. Factors and Weight Factors of Each Criterion Requirement for the Hospital Sector

	Parameters Requirements		Status	Factor “F”		Weight Factor “WF”	
HOSPITAL	**Water Monitoring**	Patient Rooms’ Bathrooms	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Toilet Facilities	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
		Shower Facilities	Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		Kitchen Facilities	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
		Laundry Facilities	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
		Domestic Hot Water System	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		Irrigation	Yes	F_7	1	WF_7	1
			No		0		1
			N/A		0		0
		Reclaimed Water	Yes	F_8	1	WF_8	1
			No		0		1
			N/A		0		0
		Laboratories	Yes	F_9	1	WF_9	1

			No		0		1
			N/A		0		0
		Surgical Suites	Yes	$\boldsymbol{F_{10}}$	1	$\boldsymbol{WF_{10}}$	1
			No		0		1
			N/A		0		0
		Treatment Areas (Physiotherapy and Hydrotherapy)	Yes	$\boldsymbol{F_{11}}$	1	$\boldsymbol{WF_{11}}$	1
			No		0		1
			N/A		0		0
		Dietary Departments	Yes	$\boldsymbol{F_{12}}$	1	$\boldsymbol{WF_{12}}$	1
			No		0		1
			N/A		0		0
		Sterile Processing Departments	Yes	$\boldsymbol{F_{13}}$	1	$\boldsymbol{WF_{13}}$	1
			No		0		1
			N/A		0		0
		Pharmaceutical Purified Water Systems	Yes	$\boldsymbol{F_{14}}$	1	$\boldsymbol{WF_{14}}$	1
			No		0		1
			N/A		0		0
		Hydronic Makeup Water System	Yes	$\boldsymbol{F_{15}}$	1	$\boldsymbol{WF_{15}}$	1
			No		0		1
			N/A		0		0
	Water Submeter Control (Connected To BMS)		Yes	$\boldsymbol{F_{16}}$	1	$\boldsymbol{WF_{16}}$	2
			No		0		2
			N/A		0		0
	Water Submeter Type		Digital with data logger	$\boldsymbol{F_{17}}$	1	$\boldsymbol{WF_{17}}$	2
			Smart		1		3

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{17} F_i * WF_i)}{(\sum_{i=1}^{17} WF_i) + (3 - WF_{17})}\right]$$

Where:

F_0 is calculated using the following formula:

If the project includes at least one energy submeter ($\sum_{i=1}^{15} F_i \neq 0$) , F_0 = 1

If the project does not include any energy submeter ($\sum_{i=1}^{15} F_i = 0$) , F_0 = 0

If the project does not include any water submeter, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the smart water submeters for all the major water uses cited above are installed and connected to the Building Management System (BMS).

RESIDENTIAL

Table 9.1.2-7. Factors And Weight Factors of Each Criterion Requirement for Residential Sector

	Parameters Requirements		**Status**	**Factor "F"**		**Weight Factor "WF"**	
RESIDENTIAL	**Water Monitoring**	Toilet (Water Closet)	Yes	F_1	1	WF_1	1
			No		0		1
			N/A		0		0
		Bathroom (Less Water Closet)	Yes	F_2	1	WF_2	3
			No		0		3
			N/A		0		0
		Kitchen	Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		Laundry	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
		Domestic Hot Water System	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
		Irrigation	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		Swimming Pool	Yes	F_7	1	WF_7	1
			No		0		1
			N/A		0		0
		Reclaimed Water	Yes	F_8	1	WF_8	1
			No		0		1
			N/A		0		0
	Water Submeter Control (Connection To BMS)		Yes	F_9	1	WF_9	2
			No		0		2
			N/A		0		0
	Water Submeter Type		Digital With Data Logger	F_{10}	1	WF_{10}	2
			Smart		1		3

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \ 100 * F_0 * \left[\frac{(\sum_{i=1}^{10} F_i * WF_i)}{\left(\sum_{i=1}^{10} WF_i\right) + (3 - WF_{10})}\right]$$

Where:

F_0 is calculated using the following formula:

If the project includes at least one energy submeter ($\sum_{i=1}^{8} F_i \ \neq 0$) , F_0 = 1

If the project does not include any energy submeter ($\sum_{i=1}^{8} F_i \ = 0$) , F_0 = 0

If the project does not include any water submeter, the score for this criterion will be 0%. A project earns a score of 100% for this criterion If smart water submeters for all the major water uses cited above are installed and connected to the Building Management System (BMS).

9.2 Family: Indoor Water Use Reduction

9.2.1 Wa-2.1: Water Saving Fixtures

9.2.1.1 Criterion Reference and Title

Wa-2.1: Water-Saving Fixtures

9.2.1.2 Criterion Type

Prerequisite

9.2.1.3 Intent

To select efficient water-saving fixtures to reduce indoor water use.

9.2.1.4 General Requirements

For the project to qualify for this criterion, it must demonstrate saving water by at least 20% by selecting efficient water-saving fixtures.

A) Baseline Indoor Water Consumption

To reduce predicted interior water use by at least 20% from the baseline by implementing water-efficiency measures related solely to water-saving fixtures.

Baseline calculations on the flow rates and volumes are based on the following table:

Table 9.2.1-1. Baseline Flow Rate and Flush Rate of Sanitary Fixtures

Fixture or fitting	Baseline
Flow Fixtures	**Flow Rate @ Pressure**
Lavatory (Public)	2 l/min @ 4.0 Bar
Lavatory (Private)	8 l/min @ 4.0 Bar
Shower	9.5 l/min @ 5.5 Bar
Bidet/Bidet Spray	8 l/min @ 4.0 Bar
Kitchen Tap	8 l/min @ 4.0 Bar
Flush Fixtures	**Flush rate**
Single Flush Toilet	6 liters per flush
Toilet (Dual Flush WC)	6/4 liters per full/low flush
Urinal	2 liters per flush

B) Improved Water Saving Strategies

- Dual Flush toilets can be used.

- Manual or automatic flush controls can be used for cisterns serving single or multiple urinals in public toilets.
- Aerators or Flow Restrictors can be used on specified faucets as a cheaper alternative to a low-flow faucet in order to reduce the flow rate.
- Auto shut-off faucets, which are activated either by a push action or electronic sensors, can be installed in all public restrooms.

C) ARZ Water Calculator in ARZ Portal

The water calculator requires information, about (1) the project occupancy, (2) the days of operation, and (3) the fixture types used in the project in order to be able to calculate and to produce the following results:

- Annual baseline of water use (m^3 per year)
- Annual proposed case of water use (m^3 per year)
- Percentage of water savings (%) as calculated per this equation:

$$\begin{matrix}\boldsymbol{Percentage\ of}\\ \boldsymbol{Water\ Saving}\ (\%)\end{matrix} = \left(\frac{Baseline\ Water\ Use - Proposed\ Water\ Use}{Baseline\ Water\ Use}\right) \times 100$$

The calculator determines the daily water usage for each fixture type based on the following equation:

$$\begin{matrix}Daily\ water\ use\ for\\ each\ flow\ fixture\ type\end{matrix} = Flow\ rate \times Duration\ of\ use \times Nb\ of\ Persons \times Uses\ per\ person\ per\ day$$

$$\begin{matrix}Daily\ water\ use\ for\\ each\ flush\ fixture\ type\end{matrix} = Fixture\ Flush \times Nb\ of\ Persons \times Uses\ per\ person\ per\ day$$

The default duration of use and the default uses per day are represented in the following table:

Table 9.2.1-2. Default Duration of Use and Uses of Sanitary Fixtures

Fixture Type	Duration (sec)	Default Uses per Day						
		Employee (FTE)	Visitors	Retail Customer	Student	Patient	Guest	Residential
Toilet (Male)	n/a	1*	0.1*	0.1*	1*	5	5	5
Toilet (Female)	n/a	3	0.5	0.2	3	5	5	5
Urinal	n/a	2	0.4	0.1	2	0	0	0
Bidets/Bidet Spray	30	3	0.5	0.2	3	5	5	5
Lavatory Faucet (Public)	60	3	0.5	0.2	3	0	0	0
Lavatory Faucet (Private)	120	0	0	0	0	5	5	5

Kitchen/Kitchenette Faucet	30	1	0	0	0	0	0	0
Kitchen Faucet (Residential)	120	0	0	0	0	4	4	4
Shower (Public)	300	0.1	0	0	0	0	0	0
Shower (Private)	480	0	0	0	0	1	1	1

* These values are applicable if urinals are available in the restrooms/toilets otherwise the values shall be the same as for female toilets.

The number of people, the uses per person per day, and the duration of each use must be the same in both the baseline and the proposed cases.

1. Occupancy and Full-Time Equivalents (FTEs)

a. Commercial

The Full-Time Equivalent (FTE) represents the number of working hours which one full-time employee completes during a fixed period of time, be it one month or one year.

Full-Time Equivalents (FTEs): FTEs are the regular building occupants who spend 40 hours per week i.e., 8 working-hours per day in the project building. Each full-time occupant has an FTE value of 1.0. Part-time or overtime occupants have FTE values based on the number of hours they work per week. Multiple shifts are either included or excluded depending on the intent and requirements of this criterion.

The total number of building occupants must be identified as:
Full-time employees/staff (8 hours/day)
Part-Time employees/staff (less than 8 hours/day)
Peak transients (visitors, customers, students, guests, etc.)

Note that when multiple shifts exist, the highest volume shift in the calculation must be used. Shift overlap must also be considered when determining peak building use.

The total Full-Time Equivalent (FTE) must be calculated as follows:

$$Total\ FTE\ Occupants = \frac{Total\ Occupant\ Working\ Hours\ per\ day}{8}$$

Transient users are occupants, such as visitors, customers, students, guests, etc., who do not use the building consistently, regularly, or on daily basis.
Transient occupancies must be input as daily totals.

b. Residential

This includes all primary spaces used for living and/or sleeping, such as apartments or multifamily residences. The resident occupancy number is based on the number and size of the residential units within the building.

Note:

(1) If the resident occupancy is known, the actual occupant counts should be used for calculating the occupancy.

(2) In case the resident occupancy is unknown, the default resident number should be estimated as follows: the total number of bedrooms (+ 1) for each residential unit.

c. Mixed Use

In case a building has mixed occupancies with different fixture uses, the resident occupancy will be reflected and documented in the water saving fixtures calculator separately for each occupancy type.

2. Gender Ratio

The gender ratio (Male/Female) for FTE occupants will be calculated automatically after the numbers of Males/Females are entered in the Water Calculator. Gender ratio affects the water usage only when urinals are available in the project. If the project does not include urinals, any male/female combination ratio should yield to the same water usage results.

Note: If occupancy for different fixture uses is known, use the actual occupant counts of different fixture uses to calculate the occupancy. When the occupancy is unknown then the total occupancy estimates must be used as per the table hereunder:

Table 9.2.1-3. Total Occupancy Estimates

	Gross square meters per occupant	
	Employees	**Transients**
General Office	23	0
Retail, General	51	12
Retail or Service (e.g., Financial, Auto)	56	12
Restaurant	40	9
Grocery Store	51	11
Warehouse, Distribution	232	0
Warehouse, Storage	1860	0
Hotel	139	65

Educational, Daycare	59	10
Educational, K–12	121	13
Educational, Postsecondary	195	14
Medical Office	21	31
Research and Development or Laboratory	37	0

9.2.1.5 Special Requirements

Special purpose buildings such as educational buildings shall adhere to the following requirements. For instance, if the educational building is used for multiple sessions annually, calculate the percentage for each session based on the number of days in the session divided by the total number of days during which the school building operates annually. For that end, use the following equation:

$$Session\ \% = Days\ in\ session\ /\ Annual\ days\ of\ \ operation$$

Then calculate the annual occupants by gender, by multiplying the number of occupants in each session by the session percentage, and then by adding the results of all sessions together, using the following equation:

$$\begin{matrix} Annual\ Occupants \\ by\ Gender \end{matrix} = \left(\begin{matrix} Session\ A\ FTEs \\ by\ Gender \end{matrix}\ x\ \ Session\% \right) + \left(\begin{matrix} Session\ B\ FTEs \\ by\ Gender \end{matrix}\ x\ \ Session\% \right)$$

9.2.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.2.1-4. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Water Calculator	• Building Water Calculator in ARZ Portal.
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications for all the proposed sanitary fixtures should indicate the flow rates and the flow regulation systems.
New Building in Construction Phase	

Submittal Name	Submittal Description
Water Calculator	• Updated Building Water Calculator (if different Design Phase)
Brief Narrative	• Updated Criterion Narrative (if different from Design Phase)
Manufacturer Datasheets	• The Manufacturer Technical Datasheets for all the installed fixtures and fittings should indicate the flow rates and the flow regulation systems.
Existing Building	
Water Calculator	• The Building Water Calculator in the ARZ web application.
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturer Datasheets	• The Manufacturer Technical Datasheets for all the installed fixtures and fittings should indicate the flow rates and the flow regulation systems.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.2.1.7 Score Allocation

The score for this criterion is determined based on the water saving generated from the selected water saving fixtures. Note that in order to qualify for this criterion, the project must demonstrate 20% of water saving solely from using efficient water-saving fixtures selected as per the ARZ water calculator. In order to determine the criterion score, the following concept is applied:

% Percentage of Water Saving from Water-Saving Fixtures	Criterion Score
Water Saving < 20%	0%
Water Saving = 20% (prerequisite)	50%
20% ≤ Water Saving ≤ 50%	50% ≤ Criterion Score ≤ 100%

9.3 Family: Landscape and Irrigation

9.3.1 Wa-3.1: Landscape Water Demand

9.3.1.1 Criterion Reference and Title

Wa-3.1: Landscape Water Demand

9.3.1.2 Criterion Type

Optional

9.3.1.3 Intent

To minimize landscaping water demand by selecting native plant species with low irrigation requirements.

9.3.1.4 General Requirements

Reduce the project's landscape water demand by selecting plant species with low water requirements. For this end, select (1) native plants, (2) adapted plants, or (3) plant species, which can solely rely on precipitation for irrigation within a two-year period from growing them. The vegetated area should be at least 20% of the site area in order to qualify for this criterion.

Native plants also known as "indigenous plants" are those which belong to "an area in which they originally originated". Native species have evolved as per the geography, hydrology, and climate of that region.

Adapted plants are not native to a particular region but have similar characteristics, which allow them to live in that region.

A landscaped area refers to all the vegetated areas within the site boundary including roof gardens. Hardscaped areas and non-vegetated surfaces, such as pavements, should be excluded from the landscaped area calculations. Food gardens may be included or excluded from the calculations at the project team's discretion.

The average landscape water demand can be calculated using the following formula:

$$LWD = \frac{\sum[Vegetated\ Zone\ Area\ (Avz) * Water\ Demand\ per\ Zone]}{Total\ Vegetated\ Area}$$

Where:

- LWD = Landscape Water Demand (liters/m^2/day)

- The Vegetated Zone Area (m^2) is determined from the project landscape plans for each plant type.
- The Water Demand per Zone (liters/m^2/day) is provided by the landscape designer and is specific to each plant species.
- The Total Vegetated Area (m2) is the sum of all the vegetated areas within the project boundary.

The score for this criterion is determined based on the percentage of the overall vegetated area and the landscape water demand. The minimum requirements are as follows:

- The vegetated area should exceed 20% of the site area.
- The Landscape Water Demand (LWD) should be less than 5 Liters/m^2/day.

9.3.1.5 Special Requirements

None

9.3.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.3.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Landscape Design Drawings	• The Landscape Design Drawings should show the total site area including all the vegetated areas.
List of Plant Species	• The List of Plant Species should include all the selected species along with the water demand per type.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Landscape As-Built Drawings	• The Landscape As-built Drawings should show the total site area including all the vegetated areas.
List of Plant Species	• The List of Plant Species should include all the selected species along with the water demand per type.
Existing Building	

Submittal Name	Submittal Description
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Landscape As-built Drawings	• The Landscape As-built Drawings should show the total site area including all the vegetated areas.
List of Plant Species	• The List of Plant Species should include all the selected species along with the water demand per type.
Irrigation Water Consumption Measured Daily During Peak Month	• The project should identify the month, when water demand for irrigation peaks, and use temporary or permanent water meters to measure the water consumption on daily basis.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.3.1.7 Score Allocation

The score for this criterion is determined based on the Landscape Water Demand (LWD) of the project. Note that the vegetated area should be at least 20% of the total site area in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * F_2$$

Where:

- F_1 is calculated using the following formula:
  If the **Vegetated Area** ≥ 20%, $F_1 = 1$
  If the **Vegetated Area** < 20%, $F_1 = 0$
- F_2 is calculated using the following formula:
  If the **LWD** ≤ 5, $F_2 = 1 - \frac{LWD}{5}$
  If the **LWD** > 5, $F_2 = 0$

A project earns a score of 100% if the landscape water demand is equal to zero and the vegetated area is more than 20% of the total site area.

9.3.2 Wa-3.2: Irrigation System Efficiency

9.3.2.1 Criterion Reference and Title

Wa-3.2: Irrigation System Efficiency

9.3.2.2 Criterion Type

Optional

9.3.2.3 Intent

To reduce landscaping water demand by installing efficient irrigation systems.

9.3.2.4 General Requirements

Reduce the project's irrigation water requirement by installing efficient irrigation systems including a distribution network and control equipment.
Irrigation Efficiency reflects the performance of a complete irrigation system and its components. Irrigation efficiency is defined as the ratio of the amount of water necessary to meet the plant water requirements to the total volume of water diverted, stored or pumped for irrigation. The water which is supplied by the irrigation system and is not absorbed by plant roots is considered as wasted water, and therefore, reduces irrigation efficiency.

For a water irrigation system to be efficient, the following measures should be considered:

- Eliminate all water spray components from the distribution network and utilize drip or subsurface irrigation to minimize evaporation.
- Irrigate only during non-daylight hours to reduce evaporation, and increase plant water absorption.
- Utilize moisture sensors to control the irrigation system operation.
- Install a weather-based controller or an evapotranspiration controller to adjust watering times based on daily weather conditions (temperature, humidity, solar irradiance, wind, etc.)
- Provide irrigation zones, which are equipped with independently controlled valves and, which are segregated by plant water needs to prevent over irrigation.
- Utilize mulching techniques to conserve soil moisture, and reduce surface water evaporation.

The annual irrigation water volume can be calculated by using the following formula:

$$IWV = \sum [\frac{Irrigated\ Zone\ Area * Water\ Demand\ per\ Zone * Controller\ Efficiency\ (CE) * Irrigation\ Days}{Application\ Efficiency\ (AE)}]$$

Where:

- IWV = The Annual Irrigation Water Volume (Liters/year)
- The Irrigated Zone Area (m^2) is determined from the project landscape plans for each type of irrigation supply.
- The Water Demand per Zone (Liters/m^2/day) is provided by the landscape designer, and is specific to each plant species. (Refer to criterion Wa-3.1)
- The Application Efficiency (AE) measures the effectiveness of the irrigation system in (1) delivering water to plant roots, and in (2) reducing the quantity of the water lost in evaporation, runoffs and deep percolation below plant roots. The table hereunder provides reference values for the Application Efficiency based on the method of irrigation:

Table 9.3.2-1. Irrigation Application Efficiency

Method of Irrigation	Application Efficiency
Surface (Furrows)	0.5
Sprinkler	0.7
Drip	0.9
Sub-Surface Drip	0.95

- Controller Efficiency (CE) is a unit of measurement or a value showing the controller's ability to automatically adjust watering schedules as per the local weather and the landscape conditions to prevent overwatering compared to a controller with a clock and a preset schedule. The CE equation is 1 minus the estimated percentage of the overall irrigation water saved by the controller. The table hereunder provides reference values for the controller efficiency based on the method of control:

Table 9.3.2-2. Controller Efficiency

Method of Control	Controller Efficiency
Manual	1
Timer/Clock	1
Moisture Sensors	0.8
Weather-Based (Evapotranspiration)	0.7

- The Irrigation Days refer to the annual irrigation days per zone.

The baseline irrigation system assumes a sprinkler irrigation (AE=0.7) with a Timer/Clock controller (CE=1) for each zone.

The irrigation system savings can be calculated using the following formula:

$$rrigation\ System\ Savings = 100 * \frac{IWV_B - IWV_P}{IWV_B}$$

Where:

- IWV_B = The Annual Irrigation Water Volume for the baseline system (Liters/year)
- IWV_P = The Annual Irrigation Water Volume for the proposed System (Liters/year)

Native or adapted plants which can rely solely on precipitation for irrigation within a two-year period from growing them can be considered as having zero irrigation water volume and achieve 100% irrigation system savings.

The score for this criterion is determined based on the percentage of the vegetated area and the irrigation system savings. The vegetated area should exceed 20% of the total site area.

9.3.2.5 Special Requirements

None

9.3.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.3.2-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Irrigation Design Drawings	• The Irrigation Design Drawings should show (1) the total site area, (2) the areas of all the vegetated zones, and (3) the irrigation system layout.
Specifications	• The Specifications for all the irrigation system components should be provided (pump, controller, sprinklers, drippers, bubblers, etc.). • The Irrigation Controller Specifications should include the Controller Efficiency. • The System Specifications should include the Application Efficiency.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
Irrigation As-built Drawings	• The Irrigation As-built Drawings should show (1) the total site area, (2) the areas of all the vegetated zones, and (3) the irrigation system layout.
Manufacturer Datasheets	• The Manufacturer Datasheets for all the irrigation system components should be provided (pump, controller, sprinklers, drippers, bubblers, etc.). • The Irrigation Controller Datasheet should include the Controller Efficiency. • The Manufacturer Datasheets should include the Application Efficiency.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Irrigation As-Built Drawings	• The Irrigation As-built Drawings should show (1) the total site area, (2) the areas of all the vegetated zones, and (3) the irrigation system layout.
Manufacturer Datasheets	• The Manufacturer Datasheets for all the irrigation system components should be provided (pump, controller, sprinklers, drippers, bubblers, …). • The Irrigation Controller Datasheet should include the Controller Efficiency. • The sprinklers, drippers, bubblers, etc. Datasheets should include the Application Efficiency.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. Project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.3.2.7 Score Allocation

The score for this criterion is determined based on the achieved irrigation system savings. Note that the vegetated area should be at least 20% of the total site area in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * F_2$$

Where:

- F_1 is calculated using the following formula:
  If the **Vegetated Area** ≥ 20%, $F_1 = 1$
  If the **Vegetated Area** < 20%, $F_1 = 0$
- F_2 is calculated using the following formula:

If the **Irrigation System Savings** ≤ 50%, $F_2 = \frac{Irrigation\ System\ Savings}{0.5}$

If the **Irrigation System Savings** > 50%, $F_2 = 1$

A project earns a score of 100% if the achieved irrigation system savings are equal to or higher than 50% and the vegetated area is more than 20% of the total site area. In addition, a project with a Landscape Water Demand (LWD) equal to zero (refer to criterion Wa-3.1) will earn a score of 100% under this criterion if the vegetated area is more than 20% of the total site area.

9.4 Family: Alternative Water Sources

9.4.1 Wa-4.1: Alternative Water Sources

9.4.1.1 Criterion Reference and Title

Wa-4.1: Alternative Water Sources

9.4.1.2 Criterion Type

Optional

9.4.1.3 Intent

To reduce the demand for fresh water and reduce the load on sewage infrastructure by utilizing alternative water sources.

9.4.1.4 General Requirements

There are various non-potable water sources, which can be utilized in a project. They include

- Condensate Water Recovery
- Rainwater and Storm Water Collection
- Greywater Recycling
- Blackwater Treatment
- Foundation Drainage Water Reuse
- Cooling Tower Blowdown.

These alternative water sources help reduce the demand for fresh water and reduce the load on public sewer networks. The design team should develop a water balance for the project, and select the best options for alternative water sources to meet the building’s demand.

Condensate Water Recovery

Condensate water is generated in the air conditioning and refrigeration systems through the dehumidification of supply air at the cooling coils. This water is usually clean with low mineral content. However, it might contain bacteria, such as Legionella, and therefore, might require treatment for certain applications. Condensate recovery can be achieved by installing a water collection and storage system.

Potential usage areas for condensate water include

- Landscape irrigation
- Toilet flushing
- Laundry and washing
- Cooling towers makeup

- Swimming pool
- Water features.

Air-conditioning systems can generate significant amount of condensate water depending on the location of the project, the type of the system and the schedule of the operation. The project team should perform the calculations to determine the potential volume of the condensate water recovery, and provide all the related details.

Rainwater and Storm Water Collection

Rainwater collection consists of On-site capture and storage of rain for later use either indoors or outdoors within the project. In climatic zones with abundant rainfall, rainwater collection and reuse can reduce the demand for fresh water, and reduce the strain on public storm-water/sewer networks and surface runoff by decreasing the amount of water discharged by the project.

The main consideration when designing a rainwater collection system is adequate sizing of the storage tank. A proper balance should be established between the size of the collection tank and the demand for water in order not to oversize or undersize the system.

The maximum quantity of water which can be collected by a rainwater collection system can be calculated using the following formula:

$$RWC = \frac{Collection\ Surface\ Area * Rainfall\ Rate * Runoff\ Coefficient}{1000}$$

Where:

- RWC = Rainwater Collection Volume (m^3/year)
- The Collection Surface Area (m^2) is the area (i.e., building roof) where rainwater is collected and diverted into the storage tank.
- The Rainfall Rate (mm/year) is the average annual rainfall at the project's location.
- The Runoff Coefficient is used to recognize that some rainwater is lost due to splashing, evaporation, leakage and/or overflow. This coefficient will vary depending on the surface type where the rainwater is collected. The table hereunder provides reference values for the runoff coefficient based on the type of the collection surface.

Table 9.4.1-1. Runoff Coefficients

Collection Surface Type	Runoff Coefficient
Metal	0.95
Concrete	0.90
Gravel	0.80

Typical usage areas for collected rainwater include

- Landscape irrigation

- Toilet flushing
- Washing.

Greywater Recycling

Greywater is defined as untreated domestic waste water, which has not come into contact with toilet waste. Greywater includes discharged water from bathtubs, showers, lavatories, and water from clothes-washers and laundry tubs. It must not include waste water from kitchen sinks or dishwashers.

Greywater recycling requires a dual drainage piping network, where separate drain lines collect the discharged water from bathtubs, showers, lavatories, and water from clothes-washers and laundry tubs. The collected greywater is usually filtered to remove large particles and then is stored ready for use. Typically, greywater can be used mainly for underground irrigation and toilet flushing. However, depending on the treatment system, treated greywater might also be used for other purposes.

Designing a greywater recycling system requires proper balance between the size of the collection, the treatment system, and the related water uses. The volume of greywater which can be used within the project depends on several factors as follows:

- The volume of the water which is discharged from the connected fixtures such as bathtubs, showers, lavatories, clothes-washers, and laundry tub (Note that water-efficient fixtures will reduce the amount of greywater available for recycling. This volume can be determined using the calculator from the “Water-Saving Fixtures” criteria.)
- The capacity and the efficiency of the greywater treatment plant
- The water uses which are associated with the greywater recycling system (To avoid the rise of unpleasant odors, greywater can’t be stored for more than 24 hours. In fact, it is within that time frame that greywater should be used otherwise it should be discharged into the building sewer.)

Blackwater Treatment

Blackwater is wastewater which has been mixed with waste from toilets and urinals. Because of its potential contamination by pathogens and grease, wastewater from kitchen sinks and dishwashers are also considered as blackwater as per some standards. Blackwater requires a Tertiary Treatment i.e., biological, or chemical treatment and then disinfection before reuse.

Designing a blackwater treatment system requires proper balance between the size of the treatment / storage system and the related water uses. The volume of blackwater, which can be used within the project, depends on several factors as follows:

- The volume of the wastewater discharged from the connected fixtures (Note that water-efficient fixtures will reduce the amount of blackwater available for treatment and reuse. This volume can be determined using the calculator from "Water-Saving Fixtures" criteria.)
- The capacity and efficiency of the blackwater treatment plant
- The water uses associated with the blackwater treatment system.

Foundation Drainage Water Reuse

Irrigating the landscape with the foundation drainage water, which must be pumped away from the building's basement or foundation, is an innovative way to reduce fresh water consumption. However, pumped well water cannot be used as an alternative water source since it is considered as a potable water source and does not meet the intent of this criterion.

9.4.1.5 Special Requirements

None

9.4.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.4.1-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should show (1) the water collection system, (2) the treatment system and (3) the distribution system for alternative water source reuse.
Specifications	• The Specifications for all the components of the collection, treatment and reuse systems should be provided.
Calculations for Alternative Water Source Annual Volume	• The Calculations should include all the assumptions, formulas and references used to determine the annual volume of alternative water source.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
As-Built Drawings	• The As-built Drawings should show (1) the water collection system, (2) the treatment system and (3) the distribution system for alternative water source reuse.
Manufacturer Datasheets	• The Manufacturer Datasheets for all the components of the collection, treatment and reuse systems should be provided.
Calculations for Alternative Water Source Annual Volume	• The Calculations should include all the assumptions, formulas and references used to determine the annual volume of alternative water source.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Drawings	• The As-built Drawings should show (1) the water collection system, (2) the treatment system and (3) the distribution system for alternative water source reuse.
Manufacturer Datasheets	• The Manufacturer Datasheets for all the components of the collection, treatment and reuse systems should be provided.
Calculations or Measurements for Alternative Water Source Annual Volume	• The Calculations should include all the assumptions, formulas and references used to determine the annual volume of alternative water source. • The Measurements should be done for a whole year, or should be extrapolated to represent a full year.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.4.1.7 Score Allocation

The score for this criterion is determined based on the water savings achieved through the use of alternative water sources. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{Alternative\ Water\ Source\ Volume\ (\frac{m^3}{year})}{Total\ Annual\ Water\ Consumption\ (\frac{m^3}{year})}$$

A project earns a score of 100% if the water savings achieved through the use of alternative water sources are equal to 100%.

9.5 Family: Management and Operations

9.5.1 Wa-5.1: Water Management Policy

9.5.1.1 Criterion Reference and Title

Wa-5.1: Water Management Policy

9.5.1.2 Criterion Type

Optional

9.5.1.3 Intent

To implement water saving measures, spread awareness, and continually monitor, control, and reduce the water footprint of the facility.

9.5.1.4 General Requirements

Water Management Policy

Develop a Water Management Policy, which demonstrates the top management's commitment to (1) reduce water consumption in the Facility, and to (2) spread awareness of water conservation. The Policy shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner's Association signatory (Residential Sector). The Water Management Policy shall comprise a Mission Statement, in which the top management shall commit to water-saving. As to the Applicant, he or she, shall be expected to

- Spread awareness among all Occupants
- Set up a Water Management Plan
- Have a nominated a Water Management Champion, who shall be responsible for achieving the targeted water savings as well as other water conservation initiatives by implementing the Water Management Plan
- Require the measurement of Key Performance Indicators (KPIs) to evaluate and validate the results of the desired savings.

The Policy shall have the following sections or attachments:

Mission Statement

Develop a mission statement which includes measurable initiatives to demonstrate a commitment to water management. Measurable initiatives could be (1) to improve the quality of the water, (2) to reduce the consumption of the water at the Facility or even in the community, (3) to encourage well water employees to maintain the same commitment at home, and (4)to lead by example, etc.

Measurement of Key Performance Indicators (KPIs)

The Facility shall have a procedure for the monitoring of water consumption Key Performance Indicators (KPIs). The procedure shall include (1) a methodology to monitor two or more KPIs of water consumption and (2) different modes of use (e.g., Domestic water, Potable water, Irrigation, Cooling Tower makeup water, etc.) for water management during Facility operation. Examples of these KPIs are

- Conducting a monthly and a yearly comparison month-on-month, year-on-year, month to the same month of previous years to show any decrease or increase in water consumption
- Making a L/m^2 comparison per department, space, floor, and type of use
- Benchmarking with other similar facilities, etc.

For Exiting Buildings, the Facility shall demonstrate that the procedure in place is applied through Evaluation Reports, which indicate the measured KPIs with the frequency of measurement and evaluation, and the resulting corrective actions taken.

Nominated Water Management Champion

The Facility shall have a nominated Water Management Champion to execute the water management initiatives.

- The water management champion is either an employee of the Facility, a resident of the Facility (Residential Sector) or otherwise subcontracted. He should report to the head of the Organization or the Owners’ Association (Residential Sector).
- He can be either a dedicated manager or officer, or a staff member who takes on this role in addition to other roles in the Facility.
- The job requirements should include the following minimum tasks:
    - Enforce Water Management Policy
    - Measure KPIs and achieve the water-saving targets
    - Raise awareness about Water Conservation
    - Track Water Consumption
    - Ensure appropriate water leak management and water system maintenance.
- The Water Management Champion shall be a qualified individual or entity, who is either certified in the field of Water Conservation or in Facility management from an industry recognized certification body, or holds a degree in engineering with a minimum of 3 years of experience in water management or Facility management.

Water-Saving Targets

The Facility shall have measurable water-saving targets and a time frame by which to have them achieved. These targets shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner's Association signatory (Residential Sector).

- These targets shall be documented as an initiative. It shall be the Water Management Champion's responsibility to share them with the occupants and to achieve them. An example of a target is the Champion's commitment to make a water reduction of "X%" year-on-year or a water reduction of "X%" by the end of year "Y".
- For Exiting Buildings, the Facility must either have an Evaluation Report, which demonstrates the achievement of these targets through water consumption records, or KPIs, which prove that the targets are on track. The KPIs expose what measures have been implemented so far and what consumption reduction has been achieved as a result to these measures.

Water Management Plan/Policy

The water management targets become achievable through the implementation of a number of tasks within a plan. The Facility shall develop a water management project plan indicating the milestones to be achieved and the associated budgets to have them achieved (if required). For Existing Buildings, the Facility shall demonstrate that one or more of these milestones was achieved.

This policy could be part of another policy, such as a Safety, Health and Environment policy, or a Social Responsibility policy, etc.

9.5.1.5 Special Requirements

None

9.5.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.5.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Water Management Plan/Policy	• A simple outline should be submitted showing the scope of the Water Management policy, which includes one or more of the following: ○ The Mission Statement ○ The proposed list of KPIs ○ The job description which details the required tasks and the minimum qualifications of the Water Management Champion ○ The outline of the Water Management Plan should be provided.
New Building in Construction Phase	
Criterion Narrative	• Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Water Management Policy	• The Water Management Policy should include one or more of the following: ○ The Mission Statement ○ The procedure for the monitoring of water consumption KPIs ○ The job description of the Water Management Champion ○ The commitment to a water-saving target ○ The water management project plan with the milestones to be achieved and the associated budgets to have them achieved, if required.
Name and Qualifications of the Water Management Champion	• The name and the qualifications of the Water Management Champion should be provided.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
Water Management Policy	• The Water Management Policy should include one or more of the following: ○ The Mission Statement ○ The procedure for the monitoring of water consumption KPIs ○ The job description of the Water Management Champion ○ The commitment to a water-saving target ○ The water management project plan with the milestones to be achieved and the associated budgets to have them achieved, if required.
Evaluation Reports of Targets	• The Evaluation Reports should include (1) the status of the targets indicated in the mission statement, (2) the measures taken, and (3) the achievement percentage of each target.
Evaluation Reports of Water Consumption KPIs	• The Evaluation Reports of the water consumption KPIs should indicate (1) the value of the KPIs, (2) the frequency of measurement, and (3) the result of the evaluation.
Name and Qualifications of the Water Management Champion	• The name and the qualifications of the water Management Champion should be provided.
Evaluation Report of Water Saving Target	• The Evaluation Report of Water Saving Target should either demonstrate the achievement of this target, or provide KPIs, which prove that the target is on track.
Current Water Management Plan	• A current water management project plan should be established indicating the milestones to be achieved and the associated budgets to have them achieved, if required. • It should be demonstrated that one or more of these milestones have been achieved.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.5.1.7 Score Allocation

The score for this criterion is determined based on the above parameters, which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 9.5.1-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Does the Facility have a Water Management Policy?	1	Yes / No	1 / 0	2
If yes, does the Policy include a Mission Statement with targets to be met?	2	Yes / No	1 / 0	2
If yes, does the Policy request the measurement of KPIs?	3	Yes / No	1 / 0	3
Does the Facility have a nominated Water Management Champion?	4	Yes / No	1 / 0	3
Does the Facility have a measurable water saving target, and a time frame within which it should be achieved?	5	Yes / No	1 / 0	5
Did the Facility develop a Water Management Plan to achieve the required water-saving target?	6	Yes / No	1 / 0	5

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{6}(F_i * WF_i)}{\sum_{i=1}^{6} WF_i}\right]$$

A project earns a score of 100% by complying with each of the above requirements.

9.5.2 Wa-5.2: Water Conservation Awareness

9.5.2.1 Criterion Reference and Title

Wa-5.2: Water Conservation Awareness

9.5.2.2 Criterion Type

Optional

9.5.2.3 Intent

To improve Occupant engagement and participation in reducing the Facility's water footprint.

9.5.2.4 General Requirements

- Carryout Awareness Campaigns such that the objectives hereunder are achieved:
    - The Water Management Policy is well-communicated to all occupants through gatherings or workshops.
    - The achievements of key water-saving targets are shared with all occupants.
    - A water conservation training is offered periodically to all occupants.
    - Informative e-mails, banners, or labels are circulated / posted in the Facility.
    - A system to capture and reward successes is implemented to retain Occupant engagement.
- Allocate a budget for awareness campaigns.
- Capture Occupant feedback on how to save water and reduce water costs.

<u>Water Conservation Awareness Campaigns</u>

The campaigns shall be led and delivered either by a certified green building professional or by a Facility management professional with a minimum of 8 years of experience in water management or Facility management.

For New Buildings in the Construction Phase, at least one campaign shall be conducted before certification. The minimum required attendees shall be the managers at the facility and the maintenance team.

For Existing Buildings, at least one campaign shall be completed before certification. The minimum attendees shall be the managers of the Facility, the maintenance team, and occupants who shall be invited. The Facility shall have planned refresher campaigns every other year.

The water-saving achievements shall be shared periodically with the occupants.

Trainings should be provided either by a certified green building professional, or by a Facility management professional with a minimum of 8 years of experience in water management or Facility management.

The training shall cover at a minimum the following areas:
- An Introduction to Water Conservation: Country Challenges, Benefits, etc.
- The Water Sources and the Water Quality of the Facility
- Water Conservation at the Facility: Implemented Measures and Planned Measures
- Water Conservation Behaviors / Methods to Save Water.

The Facility shall plan and share informative materials in the form of e-mails, banners, labels, etc., to raise water conservation awareness. Such informative material shall be circulated at least quarterly.

A system to capture and reward successes shall be implemented to retain Occupant engagement, and to recognize the occupants who are actively supporting, implementing, or contributing towards the water management initiatives.

Demonstrate the above for three consecutive years, starting no later than the date of applying for certification. These could be three post-certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive.

Awareness Budget

The Facility shall have an approved five-year budget for water management awareness campaigns. The approved budget should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.

Occupant Feedback

The Facility shall circulate periodic questionnaires to seek feedback from all occupants regarding the current water conservation measures, the implementation challenges thereof, and possible opportunities to improve water conservation.

The Facility shall encourage Occupant feedback at any time. Suggestion boxes and/or a dedicated email address shall be allocated to collect feedback and suggestions concerning water collection, water conservation and other matters pertaining to sustainability.

Demonstrate this for three consecutive years, starting no later than the date of applying for certification. These could be three post-certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive. Provide the number of occupants who shared their feedback in the past three consecutive years.

For Existing Buildings, the Facility will achieve a score based on the level of participation of occupants. This measures the involvement of the occupants in water conservation and reflects the effect of the efforts of the Facility in fostering Water Management Awareness among its occupants.

9.5.2.5 Special Requirements

None

9.5.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.5.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas for Water Conservation Awareness Campaigns	• The agendas for the planned gatherings, meetings, or workshops on water conservation should be provided.
Outline of Water Conservation Training	• An Outline of the water conservation training should be provided.

Informative Materials	• The planned informative materials, which will be used to raise Water Conservation Awareness, should be provided.
Outline of the Incentive System	• The outline of the incentive system and the reward systems pertaining to the Human Resources procedures should be provided.
5-year Budget Plan for Awareness Campaigns	• A five-year plan for Water Conservation Awareness Campaigns should enclose a list of the planned events, and the total budget per annum.
Outline of Questionnaires for Water Conservation	• An outline of the questionnaires, which solicit the occupants' feedback on the current water conservation measures, challenges and opportunities, should be provided.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Water Conservation Awareness Campaigns	• The agendas for the planned gatherings, meetings, or workshops on water conservation should be provided as well as the name and qualifications of the qualified professional who led the campaign.
Attendance Sheets of Water Conservation Awareness Campaigns	• The Attendance Sheets of the Water Conservation Awareness Campaigns should list all the managers and all the members of the maintenance team, who attended and when.
The Facility Organization Chart	• The Organization Chart of the Facility or of the Owners' Association should be submitted.
Water Conservation Training	• The content of the water conservation training course and the name and qualifications of the qualified professional, who delivered the training, should be submitted.
Attendance sheets of Water Conservation Training	• At this phase, the water conservation training Attendance Sheets to submit should include at a minimum the Facility managers and the maintenance team.
Informative Materials	• The planned informative materials, which will be used to raise Water Conservation Awareness, should be provided.
Documented Incentive System	• The document which describes the incentive system should be included.

Approved 5-Year Budget for Awareness Campaigns	- The approved five-year budget for Water Conservation Awareness Campaigns should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.
Questionnaire for Water Conservation	- The questionnaire which solicits the occupants' feedback on the current water conservation measures, challenges and opportunities should be provided.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas of Water Conservation Awareness Campaigns	- The agendas of gatherings, meetings, or workshops related to Water Conservation Awareness Campaigns should be provided with the name and qualifications of the qualified professional, who led the campaign.
Attendance sheets Water Conservation Awareness Campaigns	- The Attendance sheets of the Water Management Awareness Campaigns should list all those who attended and when.
The Facility Organization Chart	- The Organization Chart of the Facility or of the Owners' Association should be submitted.
Water Conservation Training	- The content of the water conservation training course and the name and qualifications of the qualified professional, who delivered the training, should be submitted.
Attendance sheets of Water Conservation Training	- The Attendance Sheets of the water conservation training course, should include at this phase, at a minimum, the Facility Managers, the maintenance team, and 50% of the occupants.
Informative Materials	- The planned informative materials, which will be used to raise Water Conservation Awareness, should be provided.
Documented Incentive System	- The document which describes the incentive system should be included.
List of Recognized Occupants	- The list of occupants, who were recognized for their successes in water conservation at the Facility in the past three years, should be provided.
Approved 5-year Budget for Awareness Campaigns	- The approved five-year budget for Water Conservation Awareness Campaigns should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.

Expenditures for Awareness Campaigns for Three Consecutive Years	• The Expenditures for Water Conservation Awareness Campaigns for three consecutive years should be provided.
Questionnaire for Water Conservation	• The questionnaire which solicits the occupants' feedback on the current water conservation measures, challenges and opportunities should be provided.
Occupants' feedback	• Copies of the occupants' feedback to the questionnaire and the other suggestions which were made regarding water conservation for the past three years should be submitted.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.5.2.7 Score Allocation

The score for this criterion is determined based on the above parameters which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 9.5.2-2. Factors and Weight Factors for Each Parameter

Parameter	**Parameter No (i)**	**Status**	**Factor "F_i"**	**Weight Factor "WF_i"**
Is the Water Management Policy well-communicated to all occupants through gatherings or workshops?	1	Yes / No	1 / 0	1
Are achievements of key water saving targets shared with all occupants?	2	Yes / No	1 / 0	2
Is water conservation training offered periodically to all occupants?	3	Yes / No	1 / 0	3
Are informative e-mails, banners, or labels circulated / posted in the facility?	4	Yes / No	1 / 0	1

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Is a system to capture and reward successes implemented to retain Occupant engagement?	5	Yes / No	1 / 0	3
Does the Facility allocate a budget for Awareness Campaigns?	6	Yes / No	1 / 0	5
Does the Facility solicit Occupant feedback regarding water conservation?	7	Yes / No	1 / 0	5
Average number of occupants who shared feedback (averaged for the past 3 years)	8	V_8	F_8	3
Total Number of Occupants	9	V_9		

F_8 is calculated using the following formula:

$$F_8 = \left(\frac{V_8}{V_9}\right) * 2$$

Where

V_8 is the average number of Occupants who shared feedback (averaged for the past 3 years)

$$V_8 = \left(\frac{\sum_{i=1}^{3} Number\ Of\ Occuapnts\ who\ shared\ feedback_{Year\ i}}{3}\right)$$

V_9 is the total number of occupants at the Facility

F_8 Maximum value is 1

A project earns a full score 100% for this parameter if at least 50% of the occupants on average shared feedback for the past three years.

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Scre = 100 * \left[\frac{\sum_{i=1}^{8}(F_i * WF_i)}{\sum_{i=1}^{8} WF_i}\right]$$

A project earns a score of 100% by complying with each of the above requirements and by providing proof that at least 50% (cumulative) of the occupants shared feedback over the past three years.

9.5.3 Wa-5.3: Water Consumption Tracking

9.5.3.1 Criterion Reference and Title

Wa-5.3: Water Consumption Tracking

9.5.3.2 Criterion Type

Optional

9.5.3.3 Intent

To actively measure and reduce water consumption.

9.5.3.4 General Requirements

A basic management adage says: “If you can’t measure it, you can’t improve it”.

Monthly Water Records (Pre-Requisite)

For LGBC benchmarking purposes, and with the Applicant’s confidentiality fully preserved, LGBC requests the latter to commit to share the Facility’s monthly water consumption details on a yearly basis during the validity period of the ARZ certificate.

As per LGBC template, for projects to maintain certification, they shall commit to provide LGBC with the following on a yearly basis:

1- The monthly water consumption data
2- The monthly water main meter readings
3- The monthly sub-main meter readings.

The Applicant shall submit a signed declaration of this commitment as per LGBC template.

The following parameters apply to Existing Buildings only.

The Facility shall calculate the targeted value of the total water consumption (based on the current systems and usage) through one of the following methods:

- A water audit
- A water consumption model
- A suitable benchmark.

Water Audit

A third-party water audit shall be performed. This parameter is described under Wa-6.2 Water Auditing.

Water Consumption Model

A water consumption model shall be performed by a qualified third-party water modeling expert. The modeling must provide the expected annual water consumption of the Facility. The model shall comply with the following requirements:

- The third-party shall have a minimum of five years of experience in water modeling.
- The software used shall be an international reference in water modeling.
- The model shall not be more than two years old.
- No major changes in the Facility construction or use have been implemented since the model was done.

Water saving benchmark

In the absence of a water audit or a Water Model, a suitable benchmark for the total water consumption of the Facility shall be determined. The benchmark shall be from a published source and adequately adjusted to the Facility characteristics. The Facility characteristics comprise, but are not limited to, (1) the Facility condition, (2) the installed systems, (3) the mode and the hours of operation, (4) the occupancy and the location. The benchmark shall be carried out by a third-party water conservation professional, who has a minimum of 8 years of experience in water management or Facility management. The third-party water conservation professional report shall not be more than one year old.

Monthly Water Consumption

The Facility must have water consumption meter records for all its water sources either for the past three consecutive years of water consumption, or for the age of the Facility. Whichever lower record will be considered.

Provide the consumption records in the following format:

Consumption Year	**Consumption Period**		**Qty (Lit)**	**Type of Use**	**Supply**
	Start	End			

The Type of use to be monitored shall be one of the following:

- Drinking
- General
- Irrigation.

The water supply modes shall be any combination of the following external sources of supply:

- Municipality metered water supply (Membership)
- Other metered supplies
- Bottled water
- Delivery by tanker
- Metered On-site well
- Metered On-site drinking water filtration system.

Note: Ensure that the recorded submeter readings are not double-counting the main water supply in the recorded meter readings. For instance, if the main or municipality water supply, which is basically drinking water, is 10 m^3 and the net water supply saved for drinking is $2m^3$, the metered supply should be counted as such:
Main / municipality water supply (10 m^3) minus the net water supply for drinking ($2m^3$) equals the net water supply saved for other uses and which is equal to ($8m^3$).

For each water delivery or water meter reading, provide the corresponding year and the period as follows:

- Year 3 is the most recent year
- Year 2 is the previous year
- Year 1 is three years ago from the date of applying for this rating system
- The period start date is the first day of the month
- The period end date is the last day of the month.

Gross Water Consumption

The total water consumption of the twelve-month period prior to the date of applying for certification shall be equal to or lower than the total expected water consumption, which is derived from one of the above methods, namely

- Water audit
- Water consumption model
- Water-saving benchmark.

9.5.3.5 Special Requirements

None

9.5.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 9.5.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Head of the Facility Official Declaration	• The LGBC template for committing to provide water consumption data to LGBC on an annual basis should be filled and officially submitted by the Head of the Facility.
New Building in Construction Phase	
Head of the Facility Official Declaration	• The LGBC template for committing to provide water consumption data to LGBC on an annual basis should be filled and officially submitted by the Head of the Facility.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Head of the Facility Official Declaration	• The LGBC template for committing to provide water consumption data to LGBC on an annual basis should be filled and officially submitted by the Head of the Facility.
Name and Qualifications of the Water Modeling Expert	• The name and qualifications of the water modeling expert including a portfolio of his/her previous water modeling studies should be submitted.
Name and Version of the Water Modeling Software	• The Datasheet of the water modeling software should be provided.
Water Modeling Report	• Both the water modeling output (including the details of the input data used) and the water model report shall indicate the expected annual water consumption of the Facility.
The Name of the Published Source of the Benchmark	• The full reference, including the ISBN number of the published source from which the adopted water consumption benchmark is derived, should be provided.

Name and Qualifications of the Water Conservation Expert	• The name, qualifications and portfolio of previous works of the water conservation expert, who provided the benchmark for the Facility, should be submitted.
The Water Consumption Benchmark	• A detailed report of the derivation of the water consumption benchmark should be applicable to the Facility characteristics.
Water Invoices and Water Meter Readings	• Copies of all the water invoices and the water meter readings should be submitted. They should be from all possible external sources supplying water to the Facility for the past three consecutive years.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.5.3.7 Score Allocation

The score for this criterion is determined based on the aforementioned parameters, which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 9.5.3-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
In order to maintain the certification, does the Applicant commit to provide LGBC with monthly (1) water consumption data, (2) water main meters, and (3) sub-main meter readings on a yearly basis as per the LGBC template?	1	Yes / No	1 / 0	
Was a water consumption model carried out by a qualified third-party water modeling expert to guide the water saving initiative?	2	Yes / No	1 / 0	1

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Was a suitable benchmark adopted to guide the water saving initiative?	3	Yes / No	1 / 0	0
The total annual water consumption target of the Facility as per the above water audit report, water model, or benchmark is in (Liters).		V_{Target}		
Does the Facility keep monthly water consumption records?	4	Yes / No	1 / 0	1
Gross Water Consumption recent year (Liters)	5	$V_{Recent\ Yr}$	F_5	3

F_5 is calculated using the following:

Table 9.5.3-3. Factors F5 Values

$V_{Recent\ Yr}$	F_5
$\leq$ 80% of V_{Target}	100%
= V_{Target}	50%
80% of $V_{Target} \leq V_{Recent\ Yr} \leq V_{Target}$	100% ≥ F_5 ≥ 50%
> V_{Target}	0%

Where

$V_{Recent\ Yr}$ is the water consumption for the latest year in Liters

V_{Target} is the target total annual water consumption for the Facility as per the above water audit report, water model, or benchmark in (Liters)

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * \left[\frac{\sum_{i=2}^{5}(F_i * WF_i)}{\sum_{i=2}^{5} WF_i}\right]$$

A project earns a score of

- 80% if the actual water consumption is reduced to 80% of the estimated Facility consumption obtained through a water audit. The water audit is provided with an additional score in a separate criterion, or
- 80% if the actual water consumption is reduced to 80% of the estimated Facility consumption obtained through a benchmark, or
- 100% if the actual water consumption is reduced to 80% of the estimated Facility consumption obtained through a water model.

9.5.4 Wa-5.4: Water Leak Management

9.5.4.1 Criterion Reference and Title

Wa-5.4: Water Leak Management

9.5.4.2 Criterion Type

Optional

9.5.4.3 Intent

To reduce water losses due to leaks through periodical water system inspections and implementation of the needed corrective maintenance.

9.5.4.4 General Requirements

All water systems at the Facility shall undergo a pressure test during commissioning.
The water pressure test shall cover all of the water systems at the Facility including, but not limited to

- The water supply mains
- The storage tanks
- The water pumps
- The water distribution networks
- The supply fixtures
- The irrigation systems
- The firefighting systems.

The Commission (Cx) plan, shall include pressure testing of the water systems. The Cx test reports shall demonstrate that the water systems were tested successfully, and were proven leak-free. The Cx test shall be performed by the installation contractor, supervised by the engineering team, approved by the engineering office, and accepted by the Cx Agent.

For Existing Buildings, water pressure testing is not applicable.

<u>Water Leak Inspections</u>

A Water Leak Inspection Program shall be established and a job plan for leak inspections shall be included in the Operation and Maintenance manuals. The job plan shall be performed at least annually, and shall include at a minimum the following attachments:

- The drawings of each water network and the location of valves and major fittings
- The schematic drawings of water networks indicating the location, the type and the quantity of water tanks, pumps, water treatment equipment, and water supply fixtures
- The check lists for the required inspections.

The water leak inspections shall cover all the water systems and distribution networks, including, but not limited to: water tanks, pumps, water treatment systems, valves and pipe fittings, connected equipment, faucets and mixers, flush valves, flush tanks, irrigation networks, etc.

Demonstrate the above for three consecutive years, starting no later than the date of applying for certification. These could be three post-certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive.

9.5.4.5 Special Requirements

None

9.5.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.5.4-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
The Cx Plan: Water System Pressure Testing	• It is the section of the Cx Plan which requires pressure testing of all water systems in the Facility.
O&M Requirements	• Operation and Maintenance requirements shall request a job plan for water leak inspections.

New Building in Construction Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Cx Test Reports: Water System Pressure Testing	- The Cx test reports should be signed by the installation contractor, engineering supervision team, engineering firm, and the Cx Agent.
Operation and Maintenance Manuals	- The Operation and Maintenance section should include the job plans for the water leak inspections, and the specified minimum attachments.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Job Plan for Leak Inspections	- The Job Plan for Leak Inspections should include the specified minimum attachments.
Operation and Maintenance Manuals	- The Operation and Maintenance section should include the job plans for water leak inspections, and the specified minimum attachments.
Signed Water Leak Inspection Job Plans	- The Executed Water Leak Job Plans should be signed and dated by the inspector. A commitment to provide these job plans for the balance of the required three years should be made.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.5.4.7 Score Allocation

The score for this criterion is determined based on the aforementioned parameters, which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 9.5.4-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Is the water system pressure tested during commissioning and found tight?	1	Yes / No	1 / 0	1
Is the water leak inspection program established?	2	Yes / No	1 / 0	2
Is the water leak inspection program established, implemented, and documented?	3	Yes / No	1 / 0	1

In order to determine the criterion score, the following formula is applied:

For New Construction

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{2}(F_i * WF_i)}{\sum_{i=1}^{2} WF_i}\right]$$

For Existing Building

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=2}^{3}(F_i * WF_i)}{\sum_{i=2}^{3} WF_i}\right]$$

For New Construction

A project earns a score of 100% if the water system successfully passed the pressure testing, and a water leak inspection program is established.

For Existing Building

A project earns a score of 100% if a water leak inspection program is established and implemented.

9.5.5 Wa-5.5: Water Systems Operation and Maintenance

9.5.5.1 Criterion Reference and Title

Wa-5.5: Water Systems Operation and Maintenance

9.5.5.2 Criterion Type

Optional

9.5.5.3 Intent

To maintain the water systems at the Facility at their optimal performance, preserve the condition of these assets, prolong their life, and eliminate early replacements.

9.5.5.4 General Requirements

Develop Operation and Maintenance Manuals and a Maintenance Regime for all the water systems at the Facility including (if installed at the Facility) but not limited to:

- Domestic Water Tanks
- Potable Water Tanks
- Domestic Water Network
- Potable Water Network
- Irrigation Network
- Valves
- Chemical Water Treatment
- Chemical Dosing System
- Water Faucets
- Water Closets
- Urinals
- Showers
- Drinking Water Dispenser
- Laboratory Plumbing Work
- Drainage
- AC Condensate Recovery System
- Rainwater Harvesting System
- Gray Water Treatment/Reuse System
- Black Water Treatment/Reuse System.

<u>Maintenance Regime</u>

Develop a maintenance regime for all the water systems which are installed in the Facility.

The Maintenance Regime Development Process [1] requires a number of steps: (1) Identify the list of assets which constitute each system, and which will receive asset care, (2) define the Preventive Maintenance (PM) , job plans for each type of asset, and (3) assign a frequency for each PM job plan.

Figure 9.5.5-1. Maintenance Regime Development Process

In general, preventive maintenance job plan tasks fall under one of the following types of activities:

- Inspecting and Identifying Defects
- Cleaning, Greasing, Tightening
- Functional Testing.

The preventive maintenance job plan tasks shall be executed at an equal frequency or lower than in the list of minimum acceptable frequencies (as per industry best practices, and RS Means Cost Planning and Estimating for Facilities Maintenance [2]).

The frequencies in the table hereunder represent the minimum acceptable frequencies.

Table 9.5.5-1. Minimum Acceptable PM Frequencies

Minimum Acceptable PM Frequencies			
System	**Visual Inspections (Record Readings & Findings)**	**Cleaning, Greasing, Tightening**	**Function Test (Equipment (EQ.), Safety Devices, & Controls)**
Domestic Water Tanks	Monthly	Every 5 Years	Yearly
Potable Water Tanks	Monthly	Every 5 Years	Yearly
Domestic Water Network	Monthly	Every 5 Years	Yearly
Potable Water Network	Monthly	Every 5 Years	Yearly
Irrigation Network	Monthly	Every 5 Years	Yearly

Minimum Acceptable PM Frequencies			
System	**Visual Inspections (Record Readings & Findings)**	**Cleaning, Greasing, Tightening**	**Function Test (Equipment (EQ.), Safety Devices, & Controls)**
Gate Valves	Monthly	Every 5 Years	Yearly
Chemical Water Treatment	Monthly	Yearly	Yearly
Chemical Dosing System	Monthly	Yearly	Yearly
Water Faucets	Monthly	Yearly	Yearly
Water Closets	Monthly	Yearly	Yearly
Urinals	Monthly	Yearly	Yearly
Showers	Monthly	Yearly	Yearly
Drinking Water Dispenser	Monthly	Every 6 Months	Yearly
Laboratory Plumbing Work	Monthly	Yearly	Every 5 Years
Drainage	Monthly	Every 5 Years	Every 5 Years
AC Condensate Recovery System	Monthly	Yearly / Seasonal	Yearly / Seasonal
Rainwater Harvesting System	Yearly / Seasonal	Yearly / Seasonal	Yearly / Seasonal
Gray Water Treatment/Reuse System	Monthly	Yearly	Yearly
Black Water Treatment/Reuse System	Monthly	Yearly	Yearly

The operation and maintenance manuals shall include all the applicable water systems, and shall define the maintenance regime with the frequencies of each job plan.

Demonstrate that the preventive maintenance job plans were implemented.

New Building
Provide a commitment to submit necessary records to LGBC for three consecutive years, starting no later than the date of applying for certification.

Existing Building
Provide LGBC with necessary records for three consecutive years. These could be three post-certification years, the past three years, if available, or any combination of past and future years provided they are consecutive.
In case of a post-certification record submittal, a prior binding commitment to LGBC is required.

Operation and Maintenance Manuals

Develop Operation and Maintenance Manuals (O&M) for all the water systems, which are installed in the Facility.

The O&M Manuals are pivotal to enable the operation and maintenance team to provide the installed systems with the needed preventive, corrective, and predictive maintenance. The purpose of the O&M Manuals is to consolidate and explain what systems are installed, and how they are configured, operated, and maintained. [3]

The O&M Manuals shall include at a minimum the following data: [3]

- As-built Drawings and Approved Material Submittals
- Original Equipment Manufacturer (OEM) Engineering Manuals, Operation and Maintenance Manuals, Spare Parts Manuals
- Installation Requirements
- Start-up Requirements
- Site Configuration Procedures (How systems must be configured in normal operation)
- Standard Operating Procedures (SOPs)
- Emergency Operating Procedures (EOPs) (Applied during a breakdown or any other abnormal event to restore the operation to close to design conditions and stop further deterioration of systems)
- Maintenance Regime as defined above
- Studies (e.g., soils, structural, electrical, mechanical, breaker, circuit)
- Commissioning reports
- Warranty certificates (including any support agreements)
- Systems Sequence of Operation
- Recommended Spare Parts Inventory Items
- A process to continuously update the O&M Manual as changes are introduced to the system configuration, the settings, etc., or after component replacements, repairs or similar occurrences.

The above requirements for O&M Manuals are common among the following criteria:
Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4

Computer-Aided Facility Management System (CAFM)

Implement a computer-Aided Facility Management System to direct, control, and document the maintenance activities at the Facility.

A Computer-Aided Facility Management System stores (1) the Facility asset register, (2) the maintenance activities, (3) the utility meter readings, (4) the historical breakdowns and repairs, (5) the upgrades and the replacements. Therefore, the CAFM allows a complete visibility across the operations and forms a management information system for the Facility. [1]

The CAFM shall have the following minimum requirements [1]:

- An Asset Registry to store information such as main features, nameplate info, specifications, date in service, warranty details, vendors, etc.
- Work Orders to plan jobs, to allocate personnel, to book necessary materials and tools, and to track costs
- Preventive Maintenance to schedule and automatically issue work orders once the due date is reached
- Emergency Work Orders
- Service Requests
- Inventory Control
- Reporting.

The above requirements for CAFM are common among the following criteria:
Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4

9.5.5.5 Special Requirements

None

9.5.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.5.5-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Maintenance Requirements	• The tender documents shall include a section for water systems maintenance requirements and the minimum required frequencies.
O&M Manuals Requirements	• The requirements of the O&M manuals shall be part of the tender documents.
CAFM Requirements	• The tender documents shall include a section for CAFM as part of the minimum requirements.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Asset List	• A comprehensive list of all the assets per water system, which are installed at the Facility, should be submitted.
Preventive Maintenance Job Plans and Frequencies	• Water System Preventive Maintenance Job Plans showing frequencies should be submitted. A binding commitment to provide the executed job plans signed and dated by the inspector for the three post-certification years should be made.
O&M Manuals	• O&M Manuals for each water system installed at the Facility and meeting the minimum requirements should be provided.
CAFM Information	• CAFM Information, such as name, version, and features which satisfy the minimum features should be provided.
CAFM generated documents	• CAFM generated documents for Asset Registry, Work Order list, Inventory items list, PM Job Plans and frequencies should be provided.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Asset List	• A comprehensive list of all the assets per water system, which are installed at the Facility, should be submitted.

Preventive Maintenance Job Plans and Frequencies	• Water Systems Preventive Maintenance Job Plans showing frequencies should be submitted.
Job Plans	• The executed Job Plans of Water System Preventive Maintenance, which are signed and dated by the inspector, should be provided. A binding commitment to provide these job plans for the balance of the required three years should be made.
O&M Manuals	• O&M Manuals for each water system installed at the Facility and meeting the minimum requirements should be provided.
CAFM Information	• CAFM Information such as name, version, and features, which satisfy the minimum features should be provided.
CAFM generated documents	• CAFM generated documents for Asset Registry, Work Order list, Inventory items list, PM Job Plans and frequencies should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.5.5.7 Score Allocation

The score for this criterion is determined based on the aforementioned parameters which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 9.5.5-3. Factors and Weight Factors for Each Parameter

System	**Parameter No (i)**	**Min PM Frequency for all three Parameters is Achieved**	**Factor “F_i”**	**Weight Factor “WF_i”**
Domestic Water Tanks	1	Yes / No	1 / 0	1
Potable Water Tanks	2	Yes / No	1 / 0	1
Domestic Water Network	3	Yes / No	1 / 0	1
Potable Water Network	4	Yes / No	1 / 0	1

System	Parameter No (i)	Min PM Frequency for all three Parameters is Achieved	Factor “F_i”	Weight Factor “WF_i”
Irrigation Network	5	Yes / No	1 / 0	1
Gate Valves	6	Yes / No	1 / 0	1
Chemical Water Treatment	7	Yes / No	1 / 0	1
Chemical Dosing System	8	Yes / No	1 / 0	1
Water Faucets	9	Yes / No	1 / 0	1
Water Closets	10	Yes / No	1 / 0	1
Urinals	11	Yes / No	1 / 0	1
Showers	12	Yes / No	1 / 0	1
Drinking Water Dispenser	13	Yes / No	1 / 0	1
Laboratory Plumbing Work	14	Yes / No	1 / 0	1
Drainage	15	Yes / No	1 / 0	2
AC Condensate Recovery System	16	Yes / No	1 / 0	2
Rainwater Harvesting System	17	Yes / No	1 / 0	2
Gray Water Treatment /Reuse System	18	Yes / No	1 / 0	3
Black Water Treatment/Reuse System	19	Yes / No	1 / 0	3

If the system is covered in the O&M Manual as described above, then $OM_i = 1$, else $OM_i = 0$. If the system is Managed through a CAFM as described above, then $CAFM_i = 2$, else $CAFM_i = 1$.

In order to determine the criterion score, the following formula is applied only for the Systems which are installed at the Facility, or else the system is omitted:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{19}(F_i * WF_i * OM_i * CAFM_i)}{\sum_{i=1}^{19} WF_i * CAFM_i}\right]$$

A project earns a score of 100% if the Facility has a maintenance regime for every system installed at the Facility.

- The frequency of the Preventive Maintenance Job Plans should be equal to or lower than the required frequencies.

- The system details are included in the O&M manuals and meet the aforementioned requirements.

Managing the maintenance of a system through a CAFM will double the weight of that system, hence the increase to a full score of 100%.

9.6 Family: Bonus

9.6.1 Wa-6.1: Cooling Towers

9.6.1.1 Criterion Reference and Title

Wa-6.1: Cooling Towers

9.6.1.2 Criterion Type

Optional

9.6.1.3 Intent

To apply effective water and chemical management for cooling towers to control corrosion, deposition, and microbiological growths. To reduce or eliminate the use of potable water for makeup water by promoting the use of recycled water instead, or to use alternative an HVAC system type which does not use water for heat rejection.

9.6.1.4 General Requirements

In case of a cooling tower in the project, the Water Management Plan and the chemical treatment are two prerequisites among many.

1) Water Source for Makeup Water

Demonstrate that at least 25% of the cooling tower makeup water can be served using the recycled water from the air-conditioner condensate, the harvested rainwater/storm water, the treated greywater, the fire pump test water, the swimming pool filter backwash water, or any other treated wastewater type. A recycled water pipe network system will be designed and installed in the Facility to feed On-site cooling towers with recycled water. The recycled water pipes must be color-coded and different from the potable water pipes. Water meters shall be installed and calibrated for cooling towers to measure how much makeup water is used from recycled water.

2) Water Conservation Strategies

a. For New Building in Design and Construction Phase

The following water conservation strategies for cooling towers must be incorporated:

- Maximize the cycles of concentration, and minimize the bleed volume.
- Reduce the blowdown through careful monitoring and an agreed-upon set of points.
- Install a conductivity controller to automatically control the blowdown.
- Install the flow meters on makeup and blowdown lines.

- Install valves, sensors, and all accessories to prevent leaks.

b. For Existing Building

The following water conservation strategies for cooling towers must be incorporated:

- Maximize the cycles of concentration and minimize the bleed volume (min. 10 cycles)
- Reduce the blowdown through careful monitoring and an agreed-upon set of points.
- Install a conductivity controller to automatically control the blowdown.
- Install flow meters on the makeup and the blowdown lines.
- Minimize drift and prevent any overflows.
- Prevent loss from any windage or splash out.
- Monitor water levels, and maintain valves, sensors, and all the accessories to prevent leaks.
- Maintain valves, sensors, and all the equipment to prevent leaks.
- Manage backwash and system cleaning water.
- Reduce the cooling load and improve the tower/ system control.
- Keep the air handler coils well-maintained.
- Provide the best practice of management and water conservation training.

3) Water Management Plan and Chemical Treatment

For New Buildings, it is important (1) to develop and implement a water management plan and a chemical treatment for the cooling tower with the help of an effective corrosion and biological control, and (2) to ensure that the levels of the six control parameters meet the requirements displayed in the following table. For Existing Buildings, a water efficiency audit shall be conducted and implemented by a qualified third-party individual or entity, who is certified from an industry recognized certification body in water auditing.

Table 9.6.1-1. Maximum Concentrations for Parameters in Cooling Tower

Parameter	Maximum level
PH	7.0 – 9.0
Conductivity	2000 µS/cm
Total alkalinity	1000 ppm
Ca (as $CaCO_3$)	1000 ppm
SiO_2	100 ppm
Cl^-	250 ppm

22. ppm = parts per million

µS/cm = micro Siemens per centimeter

9.6.1.5 Special Requirements

None

9.6.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.6.1-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet requirements of this criterion.
Calculation	• The Calculation confirming that at least 25% of the cooling tower makeup water can be served using the Facility's recycled water.
MEP Drawings	• The MEP Drawings and details for (1) the recycled water system, for (2) the cooling tower makeup water with the piping route should be provided.
Specifications	• The Specifications of (1) the recycled water system, and (2) the makeup water piping route leading to the cooling tower should be provided.
New Building in Construction Phase	
Criterion Narrative	• Updated Criterion Narrative (if different from Design Phase).
Calculation	• Updated calculation (if different from Design Phase).
As-Built MEP Drawings	• The as-built MEP Drawings for (1) the recycled water system, and for (2) the pipe routing for the cooling tower makeup water should be provided.
Manufacturer Datasheets	• The Manufacturer Datasheets / Catalogs of (1) the recycled water system, and (2) the makeup water piping route leading to the cooling tower should be provided.
Existing Building	
Qualification	• The Qualification of the third-party individual or entity as water auditor should be provided.
Criterion Narrative	• Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
Calculation	• The Calculation confirming that at least 25% of the cooling tower makeup water can be served using the Facility's recycled water.
As-Built MEP Drawings	• Both the As-built MEP Drawings and the Photographic Evidence confirming the installation of the recycled water system with the piping route for the cooling tower makeup water should be provided.
Manufacturer Datasheets	• The Manufacturer Datasheets / Catalogs of (1) the recycled water system, and (2) the makeup water piping route leading to the cooling tower should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.6.1.7 Score Allocation

The score for this criterion is determined based on the water source for makeup water, water conservation strategies and Water Management Plan with the chemical treatment requirements. Note that the Water Management Plan and the chemical treatment requirements should be achieved to qualify for this criterion. Factors and weight factors are applied to each requirement as per the table below and for different building statuses:

For New Building

Table 9.6.1-3. Factors and Weight Factors of Each Criterion Requirement for New Building

Requirements	Description	Weight Factor "WF"	
Water Source for Makeup Water	At least 25% of the cooling tower makeup water can be served using the recycled water.	WF_1	10
	A recycled water pipe network system shall be designed and installed to provide the On-site cooling towers with recycled water.	WF_2	7
	Water meters shall be installed and calibrated for cooling towers.	WF_3	5
Water Conservation Strategies	Maximize the cycles of concentration and minimize the bleed volume.	WF_4	5
	Reduce blowdown through careful monitoring and an agreed-upon set of points.	WF_5	5
	Install a conductivity controller to control blowdown automatically.	WF_6	4

	Install flow meters on makeup water and blowdown lines.	$\boldsymbol{WF_7}$	4
	Minimize drift and prevent any overflows.	$\boldsymbol{WF_8}$	4
	Install valves, sensors and all the accessories to prevent leaks.	$\boldsymbol{WF_9}$	3
Water Management Plan and Chemical Treatment	To develop and implement a water efficiency audit for the cooling towers *	$\boldsymbol{WF_{10}}$	10
	7.0 ≤ PH ≤ 9.0 *	$\boldsymbol{WF_{11}}$	2
	Conductivity ≤ 2000 µS/cm *	$\boldsymbol{WF_{12}}$	2
	Total alkalinity ≤ 1000 ppm *	$\boldsymbol{WF_{13}}$	2
	Ca (as CaCO3) ≤ 1000 ppm *	$\boldsymbol{WF_{14}}$	2
	SiO2 ≤ 100 ppm *	$\boldsymbol{WF_{15}}$	2
	Cl- ≤ 250 ppm *	$\boldsymbol{WF_{16}}$	2
*** Minimum required (Prerequisite)**			

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \prod_{i=10}^{16} Fi * \left[\frac{\sum_{i=1}^{16}(F_i * WF_i)}{\sum_{i=1}^{16} WF_i}\right]$$

Where: F_i is the factor of each requirement as follows:

- F_i =1 if the requirements are selected as “Yes”
- F_i =0 if the requirements are selected as “No”

If the project does not include any requirements, or the Water Management Plan and the Chemical Treatment are not performed, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the requirements are met.

For Existing Building

Table 9.6.1-4. Factors and Weight Factors of Each Criterion Requirement for Existing Building

Requirements	Description	Weight Factor “WF”	
Water Source for Makeup Water	At least 25% of the cooling tower makeup water can be served using the recycled water.	$\boldsymbol{WF_1}$	10
	A recycled water pipe network system shall be designed and installed to provide the On-site cooling towers with recycled water.	$\boldsymbol{WF_2}$	7
	Water meters shall be installed and calibrated for cooling towers.	$\boldsymbol{WF_3}$	5
	Maximize the cycles of concentration and minimize the bleed volume.	$\boldsymbol{WF_4}$	5

Water Conservation Strategies	Reduce blowdown through careful monitoring and an agreed-upon set of points.	WF_5	5
	Install a conductivity controller to control blowdown automatically.	WF_6	4
	Install flow meters on makeup water and blowdown lines.	WF_7	4
	Minimize drift and prevent any overflows.	WF_8	4
	Prevent loss from any windage or splash out.	WF_9	3
	Monitor water levels, and maintain valves, sensors and all the accessories to prevent leaks.	WF_{10}	3
	Maintain valves, sensors and all the equipment to prevent leaks.	WF_{11}	3
	Manage backwash and the system cleaning water.	WF_{12}	3
	Reduce the cooling load and improve the tower/ system control	WF_{13}	3
	Keep air handler coils well-maintained.	WF_{14}	3
	Provide the best practice management and water conservation training.	WF_{15}	3
Water Management Plan and Chemical Treatment	Conduct water efficiency audit for the cooling towers *****	WF_{16}	10
	7.0 ≤ PH ≤ 9.0 *	WF_{17}	2
	Conductivity ≤ 2000 µS/cm *	WF_{18}	2
	Total alkalinity ≤ 1000 ppm *	WF_{19}	2
	Ca (as CaCO3) ≤ 1000 ppm *	WF_{20}	2
	SiO2 ≤ 100 ppm *	WF_{21}	2
	Cl- ≤ 250 ppm *	WF_{22}	2
*** Minimum required (Prerequisite)**			

The calculator will determine the exact score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \prod_{i=16}^{22} Fi * \left[\frac{\sum_{i=1}^{22}(F_i * WF_i)}{\sum_{i=1}^{22} WF_i}\right]$$

Where: F_i is the factor of each requirement as follows:

- F_i =1 if the requirements are selected as “Yes”
- F_i =0 if the requirements are selected as “No”

If the project does not include any requirements, or the Water Management Plan and Chemical Treatment are not performed, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the requirements are met.

9.6.2 Wa-6.2: Water Auditing

9.6.2.1 Criterion Reference and Title

Wa-6.2: Water Auditing

9.6.2.2 Criterion Type

Optional

9.6.2.3 Intent

To conduct a water audit in order to calculate water use, and to identify simple ways to save water by implementing certain conservation measures.

9.6.2.4 General Requirements

This criterion is applicable only for Existing Buildings. A water audit should be conducted and reported by a qualified third-party individual or entity, who is certified from an industry recognized certification body in water auditing. This water audit is meant to optimize the water efficiency of the water systems by relying on the following:

- Measurements
- Calculations
- Audit Observations
- Reports
- Discussions
- Identification of potential conservation measures
- Planning and process finalization
- Implementation.

A water audit should be conducted for each project type and for its area of use:

- Domestic Water Fixtures and Fittings
- Domestic Hot Water
- Laundry Equipment
- HVAC System using Water
- Food Service
- Non-Plumbing Water using Equipment
- Medical/Lab Equipment

- Landscape Irrigation
- Water Features
- Water Treatment
- Alternate Sources
- Industrial Processes
- Cleaning and other uses.

The following outline could be included at a minimum in the water audit report:

1. Executive summary
    - Site visit information of the building or the Facility
    - The building or the Facility's total water use per annum
    - Estimated savings from water conservation measures
    - Estimated cost and simple payback.

2. Building or Facility description
    - Building use and its surface area in square meter, Demographics, Aerial imaging.
    - Property and building/Facility overview
    - Water use characteristics
    - Benchmarking: Comparison of performance with a similar building / Facility in terms of water use.

3. Water Efficiency Plan
    - Site visit report (Status of all water end-uses with attached pictures taken during the site walk through the Facility)
    - Measurement of flow rates and use estimates of all equipment and systems using water
    - Water-use diagram showing the balance between water sources and water consumption both indoors and outdoors.
    - Quantification of costs associated with each water-using activity
    - Identification of potential measurable, achievable and realistic conservation measures
    - Estimation of the savings volumes for each conservation measure
    - Cost-benefit analysis for each water conservation measure including wastewater
    - Prioritize activities based on costs, benefits and available manpower
    - Identify the person who will take responsibility for the implementation.

4. Appendices

- Data collection sheets, checklists and calculations
- Copies of water bills
- Site drawings and building floor plans
- Interview notes and checklists
- All photographs from site visit
- Description of measurement tools
- Terms and Definitions.

9.6.2.5 *Special Requirements*

None

9.6.2.6 *Required Submittals*

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.6.2-1. Required Submittals

Submittal Name	Submittal Description
Existing Building	
Qualification	• Qualification of third-party individual or entity water auditor.
Water Audit Report	• Water audit report including water efficiency plan.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.6.2.7 *Score Allocation*

The score for this criterion is determined based on the conduction and the submittal of the water audit. If the water audit is not conducted and reported, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the water audit report is conducted and reported.

9.6.3 Wa-6.3: Innovation

9.6.3.1 Criterion Reference and Title

Wa-6.3: Innovation

9.6.3.2 Criterion Type

Optional

9.6.3.3 Intent

To support innovation and new solutions for the smart use of water resources with water reduction through water-saving technologies, systems or processes which are not rewarded by standard ARZ criteria.

9.6.3.4 General Requirements

Demonstrate any new smart solution, technology, invention, design, construction, operation, maintenance or demolition method or process, which is not covered in ARZ 2.0, and which proves to be effective in terms of water performance savings and financial analysis. The innovation must be approved by LGBC during the official rating of the submitted application. The innovation must be significant, achievable, and measurable by identifying the following:

- The intent of the proposed innovation criterion
- The proposed general and special requirements for compliance
- The proposed required submittals to demonstrate compliance.

Up to a maximum of 5 innovation items are available in aggregate from a combination of the following:

3) Approved Innovation

One or several items can be awarded for each innovation application form approved by LGBC after the submittal review process.

4) Exemplary Level of Performance according to ARZ Criteria in the Water Module

The project demonstrates exemplary performance if one or more of the following ARZ assessment criteria are met at an exemplary level of performance:

- Water Metering
- Indoor Water Consumption Reduction
- Efficient Irrigation
- Alternative Water Sources

- Management and Operation.

9.6.3.5 Special Requirements

None

9.6.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 9.6.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• Submit drawings for the proposed innovation or exemplary performance (if available).
Specifications	• Submit an extract of the specifications of the proposed innovation or exemplary performance (if available).
New Building in Construction Phase	
Criterion Narrative	• Updated Criterion Narrative (if different from Design Phase).
As-Built Drawings	• Submit As-built drawings for the proposed innovation or exemplary performance (if available).
Manufacturer Datasheets	• Submit Manufacturer datasheets / catalogs for the proposed innovation or exemplary performance (if available).
Guideline	• Provide a documentation guideline how the proposed innovation materializes.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Drawings	• Submit As-built drawings for the proposed innovation or exemplary performance (if available).
Manufacturer Datasheets	• Submit Manufacturer datasheets / catalogs for the proposed innovation or exemplary performance (if available).
Guideline	• Provide a documentation guideline how the proposed innovation materializes.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion.

The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

9.6.3.7 Score Allocation

The score for the innovation criterion is determined based on the innovation or exemplary performance achieved. The weight factor will be set once the ARZ review committee members assess the originality and performance of the submitted innovation.

Table 9.6.3-2. Weight factor for each criterion requirement

Parameters Requirements	**Weight Factor "WF"**	
Innovation Feature-1	$\boldsymbol{WF_1}$	58
Innovation Feature-2	$\boldsymbol{WF_2}$	10
Innovation Feature-3	$\boldsymbol{WF_3}$	10
Innovation Feature-4	$\boldsymbol{WF_4}$	10
Innovation Feature-5	$\boldsymbol{WF_5}$	10

The calculator will determine a preliminary score according to the weighted average score for compliance with the requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{5}(F_i * WF_i)}{\sum_{i=1}^{5} WF_i}\right]$$

10. Module: Wellness

10.1 Family: Occupant Comfort and Safety

10.1.1 We-1.1: Daylighting

10.1.1.1 Criterion Reference and Title

We-1.1: Daylighting

10.1.1.2 Criterion Type

Optional

10.1.1.3 Intent

To improve the occupants' visual comfort by providing adequate levels of natural daylight.

10.1.1.4 General Requirements

The exposure to an adequate amount of natural light can positively impact the occupants' mood and improve his/her overall health. The appropriate design of windows and the proper selection of glazing are of paramount importance to ensure the adequate amount of received daylight. It is highly recommended to avoid excessive glare, which can cause visual discomfort and hinder the benefits of daylight.

Since increasing levels of daylight might increase also the heat gain within the occupied spaces, the envelope design should take into consideration the balance between the energy performance and the resultant daylight levels.

In order to provide proper daylighting within regularly occupied spaces, the following requirements must be met:

- The glazing envelope area should be at least equal to 10% of the regularly occupied floor area.
- The Visible Light Transmittance (VLT) of the glazing envelope should be higher than 40%. The Visible Light Transmittance (VLT), which is the percentage of the visible light transmitted through the glass, depends on the color of the glass and its thickness.

The regularly occupied spaces are areas within the building itself where one occupant or more normally spend at least one hour a day on average performing their regular activities.

The score for this criterion is determined based on the percentage of the regularly occupied spaces in the areas which meet the daylighting requirements.

10.1.1.5 Special Requirements

None

10.1.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should show the area of the regularly occupied spaces and the area of the glazing envelope in each space.
Design Specifications	• The Design requirements should include the glazing envelope Visible Light Transmittance (VLT) specifications.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show the area of the regularly occupied spaces and the area of the glazing envelope in each space.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed glazing envelope showing the Visible Light Transmittance (VLT) value.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show the area of the regularly occupied spaces and the area of the glazing envelope in each space.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed glazing envelope showing the Visible Light Transmittance (VLT) value.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.1.7 Score Allocation

The score for this criterion is determined based on the percentage of the regularly occupied floor area which meets the daylighting requirements. In order to determine the criterion score, the following formula is applied

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the percentage of regularly occupied floor area with compliant daylighting ≥ 90%,
  $F_1 = 1$
  If the percentage of regularly occupied floor area with compliant daylighting < 90%,
  $F_1 = \frac{\text{Percentage of Regularly Occupied Floor Area with Compliant Daylighting}}{0.9}$

A project earns a score of 100% if the percentage of the regularly occupied floor area has at least 90% of daylighting compliance.

10.1.2 We-1.2: Indoor Air Quality

10.1.2.1 Criterion Reference and Title

We-1.2: Indoor Air Quality

10.1.2.2 Criterion Type

Optional

10.1.2.3 Intent

To improve the indoor air quality by providing adequate ventilation rates in all spaces.

10.1.2.4 General Requirements

Building operations and human activities can severely degrade the quality of the air within all spaces, which can cause discomfort to building occupants. The first step to ensure breathing healthy air indoors is by isolating or eliminating the sources of air contaminants, then by implementing mechanical or natural ventilation techniques.

The purpose of ventilation is to dilute the indoor air pollutants, such as particulate matter, Volatile Organic Compounds (VOCs), and carbon dioxide, and to prevent them from reaching critical concentration limits. Ventilation is achieved by introducing a certain amount of clean outside air either through natural ventilation, such as outside windows and doors, or through mechanical ventilation, such as fresh air fans or air-handling units.

In order to ensure that proper indoor air quality is provided within all spaces, the following requirements must be met:

- Smoking should be prohibited inside buildings, near entrances, outdoor air intakes and operable windows (refer to criterion We-3.3 for no-smoking policy requirements).
- A separation should be considered between outdoor air intakes and any exhaust or discharge points either by distancing the inlets from the outlets, or by installing a physical separation between them to prevent recirculation. The ASHRAE Standard 62.1-2019 provides the minimum requirements for the separation between air intakes and contaminated air sources.
- Indoor spaces should be either mechanically or naturally ventilated.
  - For mechanically ventilated spaces, the ventilation rates must comply with all the 62.1-2019 ASHRAE Standard requirements (Ventilation Rate Procedure).
  - For naturally ventilated spaces, the ventilation rates must comply with all the 62.1-2019 ASHRAE Standard requirements (Natural Ventilation Procedure).

The required ventilation rate within each space depends mainly on the following factors (ASHRAE Standard 62.1-2019):

- Space occupancy category
- Ventilation rate per space area (L/s/m^2)
- Ventilation rate per number of occupants (L/s/person)
- Zone air distribution effectiveness which depends on the system configuration i.e., the ceiling supply of cool air.

For the project to earn a full score for this criterion, it must comply with all the criterion requirements, which are all mandatory, including the implementation of the no-smoking policy, the separation between air intakes and air outlets, and the supply of appropriate ventilation for all indoor spaces.

10.1.2.5 Special Requirements

Healthcare facilities should meet the ventilation rates in ASHRAE Standard 170-2017, Section 7, 8 and 9.

10.1.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
No-smoking Policy	• The no-smoking Policy includes the smoking ban procedures inside the building, near entrances, outdoor air intakes and operable windows.
Design Drawings	• For the Design Drawings to comply with ASHRAE Standard 62.1-2019, they should show the separation between the air intakes and the discharge points of the exhausted air. • For the mechanically ventilated spaces to comply with ASHRAE Standard 62.1-2019, the ventilation design drawings should show the area of indoor spaces and the ventilation rate provided in each space.

Submittal Name	Submittal Description
	• For the naturally ventilated spaces to comply with ASHRAE Standard 62.1-2019, the design drawings should show the area of indoor spaces and the area of natural ventilation openings. • For Healthcare facilities to comply with ASHRAE Standard 170-2017, the ventilation design drawings should show the area of indoor spaces and the ventilation rate provided in each space.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
No-smoking Policy	• The no-smoking policy includes the smoking ban procedures inside the building, near entrances, outdoor air intakes and operable windows.
As-built Drawings	• For the As-built Drawings to comply with ASHRAE Standard 62.1-2019, they should show the separation between the air intakes and the discharge points of the exhausted air. For the mechanically ventilated spaces to comply with ASHRAE Standard 62.1-2019, the ventilation as-built drawings should show the area of indoor spaces and the ventilation rate provided in each space. • For the naturally ventilated spaces to comply with ASHRAE Standard 62.1-2019, the as-built drawings should show the area of indoor spaces and the area of natural ventilation openings. • For Healthcare facilities to comply with ASHRAE Standard 170-2017, the ventilation as-built drawings should show the area of indoor spaces and the ventilation rate provided in each space.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
No-smoking Policy	• The no-smoking policy includes the smoking ban procedures inside the building, near entrances, outdoor air intakes and operable windows.
As-built Drawings	• For the As-built Drawings to comply with ASHRAE Standard 62.1-2019, they should show the separation between air intakes and discharge points of exhausted air. For the

Submittal Name	Submittal Description
	mechanically ventilated spaces to comply with ASHRAE Standard 62.1-2019, the ventilation as-built drawings should show the area of indoor spaces and the ventilation rate provided in each space. • For the naturally ventilated spaces to comply with ASHRAE Standard 62.1-2019, the as-built drawings should show the area of indoor spaces and the area of natural ventilation openings. • For Healthcare facilities to comply with ASHRAE Standard 170-2017, the ventilation as-built drawings should show the area of indoor spaces and the ventilation rate provided in each space.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.2.7 Score Allocation

The score for this criterion is determined based on the percentage of the occupied floor area which meets the ventilation requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1 * \mathrm{F}_2 * \mathrm{F}_3$$

Where:

- F_1 is calculated using the following formula:
  If the project is enforcing the No-smoking Policy, $F_1 = 1$
  If the project is not enforcing the No-smoking Policy, $F_1 = 0$
- F_2 is calculated using the following formula:
  If the proper separation between air intakes and exhaust is provided, $F_2 = 1$
  If no separation between air intakes and exhaust is provided, $F_2 = 0$
- F_3 is equal to the percentage of occupied floor area with compliant ventilation
  If the compliant ventilation is provided in all indoor spaces, $F_3 = 1$
  If the compliant ventilation is not provided in all indoor spaces, $F_3 = 0$

This criterion is only eligible to earn the full score i.e,100% if it complies with all the aforementioned mandatory criterion requirements.

10.1.3 We-1.3: Glare Control

10.1.3.1 Criterion Reference and Title

We-1.3: Glare Control

10.1.3.2 Criterion Type

Optional

10.1.3.3 Intent

To improve the occupants' visual comfort by providing adequate glare control devices.

10.1.3.4 General Requirements

Glare is produced when intense direct or indirect (reflected) light reaches the eyes causing visual discomfort. The bright light has an intensity greater than the levels to which the eyes are adapted to. Therefore, glare is distracting to the occupant and may cause eyestrain if not properly controlled.

The main source of glare is the direct sunlight through the glazing envelope or the indirect sunlight which is reflected from surfaces to reach the occupants. Artificial indoor and outdoor lighting can also cause glare if not properly oriented or shielded. However, this criterion only focuses on solar glare.

In order to provide proper solar glare control within regularly occupied spaces, at least one of the following requirements must be provided:

- Controllable interior window shading or blinds either set manually or set on a timer based on daily solar exposure hours.
- Controllable external shading systems either set manually or set on a timer based on daily solar exposure hours.
- Variable opacity glazing, such as electrochromic glass, which can reduce transmissivity by 90% or more.

The regularly occupied spaces are areas within the building itself where one occupant or more normally spend at least one hour a day on average performing their regular activities.

The score for this criterion is determined based on the percentage of the glazing envelope area within regularly occupied spaces which are provided with glare control devices.

10.1.3.5 Special Requirements

None

10.1.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should show (1) the area of the glazing envelope within the regularly occupied spaces and (2) the area of the glazing with the glare control located in each space.
Design Specifications	• The Design Specifications should include the specifications of the indoor / outdoor shading devices, or of the electrochromic glass.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show (1) the area of the glazing envelope within the regularly occupied spaces and (2) the area of the glazing with the glare control located in each space.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed indoor / outdoor shading devices, or for the electrochromic glass.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show (1) the area of the glazing envelope within the regularly occupied spaces and (2) the area of the glazing with the glare control located in each space.

Submittal Name	Submittal Description
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed indoor / outdoor shading devices, or for the electrochromic glass.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.3.7 Score Allocation

The score for this criterion is determined based on the percentage of the glazing envelope area within regularly occupied spaces, which are provided with glare control devices. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the percentage of the glazing envelope area within regularly occupied spaces is provided with Glare Control Devices ≥ 90%, $F_1 = 1$
  If the percentage of glazing envelope area within regularly occupied spaces is provided with glare control devices < 90%,

$$F_1 = \frac{\text{Percentage of Glazing Envelope Area within Regularly Occupied Spaces Provided with Glare Control Devices}}{0.9}$$

A project earns a score of 100% if the percentage of the glazing envelope area within the regularly occupied spaces provided with glare control devices is at least 90%

10.1.4 We-1.4: Artificial Lighting

10.1.4.1 Criterion Reference and Title

We-1.4: Artificial Lighting

10.1.4.2 Criterion Type

Optional

10.1.4.3 Intent

To improve the occupants' visual comfort by providing adequate levels of artificial lighting.

10.1.4.4 General Requirements

Light level or illuminance is the amount of light density measured on the work plane in the occupied space. It is measured in foot candles (fc) which is equivalent to one lumen (lm) of light output per square foot, or in Lux which is equivalent to one lumen per square meter.

Adequate light levels are essential since they ensure the safety of the workplace, and enable building occupants to perform their tasks efficiently. By preventing eyestrain, proper light levels allow occupants to work comfortably for longer periods of time, and, thus increase their overall productivity.

The recommended minimum and maximum light levels depend mainly on the space category which affects the application and tasks to be performed by the occupants. In addition to lux levels, light quality is also an important aspect to consider when selecting indoor lighting fixtures. The Color Rendering index (CRI) is a measure of light quality which refers to the ability of a light source to reveal the true colors of objects in comparison with natural light source. It is measured on a scale between 0 and 100, the higher the CRI values are, the more improved the light quality they produce is.

In order to provide adequate lighting within regularly occupied spaces, the following requirements must be met:

- Horizontal lighting lux levels should meet the recommended light levels specified in the Illuminating Engineering Society (IES) Lighting Handbook (10th Edition).
- Color Rendering Index (CRI) of lighting sources should be higher than 80.
- A lighting control should be provided to allow the adjustment of the light levels by the occupants to meet their preferences.

The following includes the acceptable lighting control strategies

(1) For individually occupied spaces
  - Light dimming controls
  - Multi-circuit lighting, including task lighting
  - Combination of daylighting and manual switching

(2) For shared occupancy spaces
  - General lighting to meet the minimum light levels along with task lighting for the individual control
  - Multizone lighting control with multilevel switching to adjust light levels in each zone
  - Combination of daylighting and multizone switching

Regularly occupied spaces are areas within the building where one or more occupant normally spend on average at least one hour per day performing regular activities.

The score for this criterion is determined based on the percentage of the regularly occupied spaces which are provided with compliant light levels and occupant controls.

10.1.4.5 Special Requirements

None

10.1.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.4-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Lighting Design Drawings	• The Lighting Design Drawings should include the lighting layout and the lighting control circuits.
Lighting Design Calculations	• The Lighting Design Calculations should include the calculations of the light level (lux) within each space.
Design Specifications	• The Design Specifications should include specifications of the proposed lighting fixtures and the minimum Color Rendering Index (CRI) of each fixture.

Submittal Name	Submittal Description
	• The Design Specifications should include specifications of the lighting control system.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Lighting As-built Drawings	• The As-built Lighting Drawings should include the lighting layout and the lighting control circuits.
Lighting level measurements	• The Lighting Level Measurements should be conducted on sample spaces from each category to confirm compliance with the recommended values.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed lighting fixtures showing Color Rendering Index (CRI) value. • The Material Datasheets should be provided for the lighting control system.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Lighting As-built Drawings	• The Lighting As-built Drawings should include the lighting layout and the lighting control circuits.
Lighting Level Measurements	• The Lighting level measurements should be conducted on sample spaces from each category to confirm compliance with the recommended values.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed lighting fixtures showing Color Rendering Index (CRI) value. • The Manufacturer Datasheets should be provided for the lighting control system.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.4.7 Score Allocation

The score for this criterion is determined based on the percentage of the regularly occupied floor area whose light levels and controls are compliant. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the percentage of regularly occupied spaces with compliant light levels and controls ≥ 90%, $F_1 = 1$
  If percentage of regularly occupied spaces with compliant light levels and controls < 90%,
  $F_1 = \frac{\text{Percentage of Regularly Occupied Spaces with Compliant Light Levels and Controls}}{0.9}$

A project earns a score of 100% if the regularly occupied spaces with compliant light levels and controls count for at least 90%.

10.1.5 We-1.5: Outdoor Views

10.1.5.1 Criterion Reference and Title

We-1.5: Outdoor Views

10.1.5.2 Criterion Type

Optional

10.1.5.3 Intent

To improve the occupants' health and wellness by providing access to outdoor views.

10.1.5.4 General Requirements

Exposure to natural outdoor environment is proven to provide positive mood improvement and increase happiness among building occupants. Providing access to outdoor views can also boost the occupants' productivity as they will feel more connected to their surroundings.

In order to provide adequate outdoor views within regularly occupied spaces, the following requirements must be met:

- Eligible outdoor views can be either one of the following:
    - Plant life (Flora): trees, flowers and other plants
    - Animal life (Fauna): birds, fish and other animals
    - Open view of the sky
    - Outdoor movement: people walking, vehicles passing
- Only areas within 7.5 meters from the glazing envelope can be considered as having access to outdoor views.

The regularly occupied spaces are areas within the building itself where one occupant or more normally spend at least one hour a day on average performing their regular activities.

The score for this criterion is determined based on the percentage of the regularly occupied spaces which have access to outdoor views.

10.1.5.5 Special Requirements

None

10.1.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.5-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design drawings	- The Design Drawings should show (1) the area of the regularly occupied spaces and (2) the area within 7.5 meters of the glazing envelope with access to eligible outdoor views.
Site layout	- The site layout should indicate the outdoor areas which can be viewed from each space.
New Building in Construction Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	- The As-built Design Drawings should show (1) the area of the regularly occupied spaces and (2) the area within 7.5 meters of the glazing envelope with access to eligible outdoor views.
Site Layout	- The site layout should indicate the outdoor areas which can be viewed from each space.
Photos of outdoor views	- The photos should show the eligible outdoor views as seen from the regularly occupied spaces.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	- The As-built Design Drawings should show (1) the area of the regularly occupied spaces and (2) the area within 7.5 meters of the glazing envelope with access to eligible outdoor views.
Site layout	- The site layout should indicate the outdoor areas which can be viewed from each space.
Photos of outdoor views	- The photos should show the eligible outdoor views as seen from the regularly occupied spaces.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.5.7 Score Allocation

The score for this criterion is determined based on the percentage of the regularly occupied spaces which have access to eligible outdoor views. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the percentage of regularly occupied spaces with access to outdoor views ≥ 90%,
  $F_1 = 1$
  If the percentage of regularly occupied spaces with access to outdoor views < 90%,
  $F_1 = \frac{\text{Percentage of Regularly Occupied Spaces with Access to Outdoor Views}}{0.9}$

A project earns a score of 100% if the percentage of regularly occupied spaces which have access to outdoor views is at least 90%.

10.1.6 We-1.6: Thermal Comfort

10.1.6.1 Criterion Reference and Title

We-1.6: Thermal Comfort

10.1.6.2 Criterion Type

Optional

10.1.6.3 Intent

To improve the occupants' comfort by providing adequate levels of thermal comfort.

10.1.6.4 General Requirements

"Thermal comfort is the condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation (ANSI/ASHRAE Standard 55)". Providing satisfactory thermal comfort conditions can positively impact people's mood and improve their productivity. However, since thermal comfort conditions are subjective and differ from one individual to another, providing thermal environment controls is important to satisfy individual or group needs.

Thermal comfort conditions are mainly affected by the following factors (ASHRAE Standard 55-2017):

- Clothing level (Clo)
- Activity level (Metabolic rate - Met)
- Indoor air temperature (◦C)
- Radiant temperature (◦C)
- Indoor air relative humidity (%)
- Air speed (m/sec)

Typical clothing levels for summer and winter are shown in the table hereunder:

Clothing Levels	
Clothing	**Clo**
Typical summer indoor clothing	0.5
Typical winter indoor clothing	1

Typical activity levels (Metabolic Rates) for various types of activities are shown in the table hereunder (ASHRAE Standard 55-2017):

Metabolic Rates		
Activity		**Metabolic Rate (Met)**
Resting	Sleeping	0.7
	Reclining	0.8
	Seated, quiet	1.0
	Standing, relaxed	1.2
Walking (on level surface)	0.9 m/s, 3.2 km/h, 2.0 mph	2.0
	1.2 m/s, 4.3 km/h, 2.7 mph	2.6
	1.8 m/s, 6.8 km/h, 4.2 mph	3.8
Office Activities	Reading, seated	1.0
	Writing	1.0
	Typing	1.1
	Filing, seated	1.0
	Filing, standing	1.4
	Walking about	1.7
	Lifting/packing	2.1
Driving/Flying	Automobile	1.5
	Aircraft, routine	1.2
	Aircraft, instrument landing	1.8
	Aircraft, combat	2.4
	Heavy vehicle	3.2
Miscellaneous Occupational Activities	Cooking	1.8
	House cleaning	2.7
	Seated, heavy limb movement	2.2
	Machine work-sawing (table saw)	1.8
	Machine work-light (electrical industry)	2.2
	Machine work-heavy	4.0
	Handling 50 kg (100 lb) bags	4.0
	Pick and shovel work	4.4
Miscellaneous Leisure Activities	Dancing, social	3.4
	Calisthenics/exercise	3.5
	Tennis, single	3.8
	Basketball	6.3
	Wrestling, competitive	7.8

The thermal sensation scale is split into 7 different categories as shown in the table hereunder (ASHRAE Standard 55-2017):

Thermal Sensation Scale	
PMV*	**Thermal sensation category**
-3	Cold
-2	Cool
-1	Slightly Cool
0	Neutral
+1	Slightly Warm
+2	Warm
+3	Hot

*The Predicted Mean Vote or PMV is an index which predicts the mean value of the thermal sensation votes of a large group of persons based on a sensation scale expressed from –3 to +3 corresponding to the categories listed in the above table.

In order to provide adequate thermal comfort levels within regularly occupied spaces, the following requirements must be met:

- Thermal comfort conditions should meet the following requirements:
    - Predicted Mean Vote: -0.5 ≤ PMV ≤ +0.5
    - Predicated Percentage Dissatisfied: PPD ≤ 10%
      PPD is an index which establishes a quantitative prediction of the percentage of thermally dissatisfied people determined from PMV.
- Air speed should not exceed 0.2 m/s.
- The thermal comfort control should be provided to allow the adjustment of the thermal conditions by the occupants to meet their preferences. Acceptable control strategies include the following:
  For individually occupied spaces, the following control strategies are acceptable:
    - Dedicated thermal environment control (room temperature and air speed control)

  For shared occupancy spaces, the following control strategies are acceptable:

- Multizone thermal environment control (perimeter / core zoning). Perimeter zones are typically 4 meters deep.

The regularly occupied spaces are areas within the building itself where one occupant or more normally spend at least one hour a day on average performing their regular activities.

The score for this criterion is determined based on the percentage of the regularly occupied spaces which have adequate thermal comfort conditions and controls.

10.1.6.5 Special Requirements

None

10.1.6.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.6-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should show the area of the regularly occupied spaces and the area provided with separate thermal comfort controls.
Calculations for Thermal Comfort Conditions	• The Calculations for thermal comfort conditions should include PMV and PPD calculations for all the regularly occupied spaces based on the proposed design conditions.
Design Specifications	• The Design Specifications should include specifications for the thermal comfort controls.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show the area of the regularly occupied spaces and the area provided with separate thermal comfort controls.
Calculations for Thermal Comfort Conditions	• The Calculations should include PMV and PPD calculations for all the regularly occupied spaces based on the measured thermal conditions.

Submittal Name	Submittal Description
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed thermal comfort controls.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show the area of the regularly occupied spaces and the area provided with separate thermal comfort controls.
Calculations for Thermal Comfort Conditions	• The Calculations for thermal comfort conditions should include PMV and PPD calculations for all the regularly occupied spaces based on the measured thermal conditions.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for the installed thermal comfort controls.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.6.7 Score Allocation

The score for this criterion is determined based on the percentage of the regularly occupied spaces which have adequate thermal comfort conditions and controls. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the percentage of regularly occupied spaces with compliant thermal comfort conditions ≥ 90%, $F_1 = 1$
  If percentage of regularly occupied spaces with compliant thermal comfort conditions < 90%,
  $$F_1 = \frac{\text{Percentage of Regularly Occupied Spaces with Compliant Thermal Comfort Conditions}}{0.9}$$

A project earns a score of 100% if the percentage of regularly occupied spaces which have adequate thermal comfort conditions and controls is at least 90%.

10.1.7 We-1.7: Acoustic Comfort

10.1.7.1 Criterion Reference and Title

We-1.7: Acoustic Comfort

10.1.7.2 Criterion Type

Optional

10.1.7.3 Intent

To improve the occupants' comfort by providing adequate levels of acoustic comfort.

10.1.7.4 General Requirements

Noises within occupied spaces can be a major source of distraction and discomfort which can have a detrimental effect on the occupants' health, and lead to decreased productivity. Providing acoustic comfort consists of minimizing intruding noises in order to maintain satisfaction within occupied spaces.

There are many sources of noise which can cause discomfort to occupants, such as

- Background indoor noise generated by operating HVAC equipment
- Noise from adjacent spaces which travels through partition walls, floors and openings
- Outdoor noises which enter mainly through external windows and doors
- Other noises generated by operating equipment (e.g., printers), and human activity (e.g., walking, typing, talking, etc.).

The proper design and selection of high-quality construction materials can greatly improve the noise reduction abilities of building partitions, such as walls, doors and windows which act as sound barriers. They also reduce the sound transmission between adjacent spaces and the outdoor environment. However, sound reduction treatments which incorporate absorptive surfaces, such as wall panels, ceiling baffles, and surface enhancements, can also help with the reverberation management and improve the acoustic comfort.

The noise level is measured in decibels (dB); the louder the noise, the higher the decibels. The decibels can be adjusted to human hearing in which case the measured values are expressed in decibels A (dBA). The Sound Transmission Class (STC) is an integer rating of sound isolation of building assemblies. STC rating roughly reflects the decibel reduction of noise which a partition can provide.

In order to provide adequate acoustic comfort levels within regularly occupied spaces, the following requirements must be met:

- The HVAC background noise (dBA) should not exceed the maximum levels referred to in ASHRAE HVAC Applications Handbook, Chapter 48, Table 1: Design Guidelines for HVAC-Related Background Sound in Rooms.
- The Sound Transmission Class (STC) of building partitions should meet the following:
  - Partition Walls: STC ≥ 50
  - External Windows: STC ≥ 35
  - Doors: STC ≥ 30

The regularly occupied spaces are areas within the building itself where one occupant or more normally spend at least one hour a day on average performing their regular activities.

The score for this criterion is determined based on the percentage of the regularly occupied spaces which meet the acoustic comfort requirements.

10.1.7.5 Special Requirements

None

10.1.7.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.7-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should show the area of the regularly occupied spaces and the details of the building partitions.
Design Specifications	• The Design specifications should include the requirements for the HVAC background noise. • The Design Specifications should include the sound transmission class requirements of the partition elements.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show the area of the regularly occupied spaces and the details of the building partitions.

Submittal Name	Submittal Description
HVAC Background Noise Measurements	• Measurements should be conducted to confirm that the achieved HVAC background noise levels are within the acceptable limits.
Manufacturer Datasheets/Calculations	• The Manufacturer Datasheets or Calculations of the installed building partitions should be provided , and should show the Sound Transmission Class (STC) value.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show the area of the regularly occupied spaces and the details of the building partitions.
HVAC Background Noise Measurements	• Measurements should be conducted to confirm that the achieved HVAC background noise levels are within acceptable limits.
Manufacturer Datasheets/Calculations	• The Manufacturer Datasheets or Calculations of the installed building partitions should be provided , and should show the Sound Transmission Class (STC) value.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.7.7 Score Allocation

The score for this criterion is determined based on the percentage of the regularly occupied spaces which meet the acoustic comfort requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \mathrm{F}_1$$

Where:

- F_1 is determined as follows:
  If the percentage of regularly occupied spaces with acoustic comfort conditions ≥ 90%,
  $F_1 = 1$
  If the percentage of regularly occupied spaces with acoustic comfort conditions < 90%,
  $F_1 = \frac{\text{Percentage of Regularly Occupied Spaces with Compliant Acoustic Comfort Conditions}}{0.9}$

A project earns a score of 100% if the percentage of regularly occupied spaces which meet the acoustic comfort requirements is at least 90%.

10.1.8 We-1.8: Occupant Safety

10.1.8.1 Criterion Reference and Title

We-1.8: Occupant Safety

10.1.8.2 Criterion Type

Optional

10.1.8.3 Intent

To ensure occupant safety and well-being by providing necessary safety measures.

10.1.8.4 General Requirements

The following safety measures should be implemented to ensure occupants' safety:

#	Occupant Safety Measure
1	Gas leak detection system
2	Fire alarm system
3	Fire protection system compliant with fire safety report
4	Earthing system for whole building
5	Differential circuit breakers in all panels
6	Lightning protection system
7	Containment for water and drainage networks for protection of electrical equipment
8	Emergency lighting system with backup power
9	Guardrails and barriers to prevent falls
10	Interior and exterior floor surfaces do not pose slip or trip hazards

Gas Leak Detection System

A) Residential Buildings

Private residential units are allowed to have a maximum of 20kg (2 x 10kg cylinders) to be installed or stored within the dwelling unit for domestic use.

Gas cylinders shall be placed in a well-ventilated area where any gas leakage can safely and rapidly disperse. It is preferred to be located outside (balcony, terrace, etc.) and 1.5m horizontally away from any air openings.

The gas installation shall be provided with at least one approved portable B:C rating dry chemical fire extinguisher with a minimum capacity of 6kg.

A gas leak detector must be provided in the kitchen area next to each oven and gas consuming equipment, and in the compartment where the LPG cylinders, pipe works and ancillary fittings are installed.

The gas leak detector should be a stand-alone device, and should
- Be supplied directly from the dwelling electrical power supply with backup batteries
- Be tamper-proof
- Have an 85dB audible alarm
- Be easy to operate by occupants with clearly visible status indication LEDs: power, alarm, fault.

B) Non-Residential Buildings
LPG cylinders shall be preferably located outdoors and placed on a firm, clean, dry and level base. They shall be sited in a well-ventilated area where any gas leakage can safely and rapidly disperse. They shall not be placed close to any passageways or exits, and shall not cause any obstruction or danger to the occupants during gas leakage or fire.
All the pipes penetrating a fire wall or a floor slab shall be fire-stopped appropriately.
The LPG installation shall be provided with at least one approved portable B:C rating dry chemical fire extinguisher having a minimum capacity of 9kg.
An approved gas-leak detection system with a local alarm connected to a main fire alarm panel shall be provided in the area or compartment where the internal LPG pipes and fittings are installed.. The system shall be linked to an emergency shut-off valve. For kitchens provided with a fixed fire suppression system, the activation of the system shall automatically shut off the supply of LPG to the kitchen. A remote emergency shut-off valve shall be located at least 3m away from the edge of the installation. It shall be clearly marked and placed at a suitable height for easy access during emergencies.
A warning sign or notice of a minimum size of 1300mm x 600mm shall be permanently and legibly displayed at the front of the installation. It shall read in a minimum of 40mm high red letterings: "LPG / HIGHLY FLAMMABLE / NO SMOKING / NO NAKED LIGHTS" on white background.

Fire Alarm System (NFPA 72)

A fire alarm system should be installed in buildings in order to provide early fire detection to protect the occupants. The occupants should be notified via visual and audible appliances (in case public address speakers interfaced with the fire alarm system are not present).
For residential buildings, a standalone optical smoke alarm should be installed outside sleeping areas, within 7.5m of any door. A standalone heat alarm should be installed in the kitchen and in the laundry.
For non-residential buildings, a fire alarm system should be installed to provide protection throughout the building. No point on the ceiling should be more than 5.3m away from a heat detector, and 7.5m away from an optical smoke detector. Manual call points should be

installed on all exits. Additional manual call points should be installed in such a way that individuals should not travel more than 45m to the nearest call point.

Fire Protection System Compliant with Fire Safety Report

The aim of a fire protection system is to safeguard a building's occupants and minimize the damage associated with fire. Overall, the ultimate goal is to provide the widest possible window for a safe evacuation, whilst also reducing potential repair costs.

There are many types of fire protection systems, and the selection depends on the application (refer to the project fire safety report for a proper system selection).

Earthing System

"An earthing system or grounding system connects specific parts of an electric power system with the ground, typically the Earth's conductive surface, for safety and functional purposes." The maximum permissible resistance to earth value is 10 ohms.

Differential Circuit Breaker

A differential circuit breaker is a device which opens the circuit once it detects current leakage between line and neutral.

Differential circuit breakers should be used on the primary supply cable in each panel. They prevent any imbalance between input and output currents, which may lead the current to be earthed via the human body in some cases.

Lightning Protection System

A lightning protection system intercepts, conducts and disperses lightning strikes safely to earth to which a metal rod mounted on a structure is connected.

Containment for water and drainage networks for protection of electrical equipment

Containment for water and drainage networks should be provided to prevent any water leakage from reaching electrical components thus causing severe damage.

Emergency lighting system with backup power

An emergency lighting system— independent of the main lighting system—consists of luminaires with separate backup power, which, in case of power failure, automatically provide the necessary illumination and time to allow for occupants' evacuation.

Guardrails and Barriers to Prevent Falls

Guardrails can protect building occupants from a fall not only on leading edges, but also around holes in the walking/working surface, stairways, ramps, or any other unprotected edges.

Interior and Exterior Floor Surfaces Do Not Pose Slip or Trip Hazards

Walking surfaces which prevent slip and trip hazards include non-slip floor mats, pressure-sensitive abrasive strips, or abrasive-filled paint-on coating, and metal or synthetic decking.

The score for this criterion is determined based on the number of implemented Occupant safety measures.

10.1.8.5 Special Requirements

None

10.1.8.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.8-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should show the compliance with each safety measure.
Design Specifications	• The Design Specifications should include the specifications of all the materials and should show their compliance with the safety measures requirements.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show compliance with each safety measure.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for all the materials to confirm compliance with the safety measures requirements.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show compliance with each safety measure.
Manufacturer Datasheets	• The Manufacturer Datasheets should be provided for all the materials to confirm compliance with the safety measures requirements.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.8.7 Score Allocation

The score for this criterion is determined based on the number of the implemented safety measures. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \quad {}_1$$

Where:

- F_1 is calculated using the following formula:

$$F_1 = \frac{Number\ of\ implemented\ Occupant\ Safety\ Measures}{10}$$

A project earns a score of 100% for this criterion by implementing all ten Occupant safety measures.

10.1.9 We-1.9: Building Accessibility

10.1.9.1 Criterion Reference and Title

We-1.9: Building Accessibility

10.1.9.2 Criterion Type

Optional

10.1.9.3 Intent

To provide building accessibility to individuals with physical disability.

10.1.9.4 General Requirements

To provide easy access and mobility for individuals with physical disabilities in new and existing buildings is an important feature of an equitable sustainable building, which ensures better community solidarity and support.

In order to provide the suitable building access and make everyday tasks easier for individuals with disabilities, all the requirements listed in the table hereunder should be implemented.

#	Building Accessibility Requirements
1	**Accessible Parking:** Handicapped parking spaces should be located on the shortest accessible route to an accessible entrance. These parking spaces should be designed so that persons with disabilities are not required to move behind parked cars other than their own.
2	**Accessible Routes:** Practical direct accessible routes of travel should be provided from handicapped parking spaces to all building entrances and exterior ground level exits by incorporating pedestrian ramps, walks, and sidewalks. Ramp runs must have a running slope no steeper than 1:12. However, in existing sites, slopes may be steeper than 1:12 if necessary due to space limitations.
3	**Elevators and Stairways:** Elevators should provide easy access for persons with disabilities. Main access stairs should provide easy access regardless of whether access is provided via elevators. Handrails should be provided on both sides of stairs and ramps and should be continuous within the full length of each stair flight or ramp run.

4	**Doors:** Any door should be made accessible to persons with disabilities. Doorway openings should provide a minimum clear width of 80 cm and a door handle for the handicapped should be located between 75 cm and 110 cm above the floor.
5	**Bathrooms:** Bathrooms provided for persons with disabilities should have accessible fixtures and accessories (such as grab rails) and clear floor spaces for each fixture. Each space must be clear by at least 75 cm by 120 cm so that an individual in a wheelchair may be able to rotate with ease.
6	**Drinking Fountains:** Drinking fountains should have spout outlets which are 90 cm (maximum) above the ground. The spout must be at least 45 cm from the vertical support and no more than 15 cm from the front edge of the unit.
7	**Signs:** Toilet facilities, rooms and parking spaces dedicated for persons with disabilities should be identified with signs. The signs should have a matte, non-glare finish, and should display a contrast (light-on-dark or dark-on-light) between the lettering and the background for more visibility.

The score for this criterion is determined based on the number of implemented building accessibility requirements.

10.1.9.5 Special Requirements

None

10.1.9.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.1.9-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should show compliance with each building accessibility requirement.

Submittal Name	Submittal Description
Design Specifications	- The Design Specifications should include specifications of all the materials, which comply with the building accessibility requirements.
New Building in Construction Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	- The As-built Drawings should show compliance with each building accessibility requirement.
Manufacturer Datasheets	- The Manufacturer Datasheets should be provided for all the materials to confirm compliance with the building accessibility requirements.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	- The As-built Drawings should show compliance with each building accessibility requirement.
Manufacturer Datasheets	- The Manufacturer Datasheets should be provided for all the materials to confirm compliance with the building accessibility requirements.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.1.9.7 Score Allocation

The score for this criterion is determined based on the number of the implemented building accessibility requirements. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1$$

Where:

- F_1 is calculated using the following formula:

$$F_1 = \frac{Number\ of\ implemented\ Building\ Accessibility\ Requirements}{7}$$

A project earns a score of 100% for this criterion by implementing all seven building accessibility requirements.

10.2 Family: Materials Emissions

10.2.1 We-2.1: No Hazardous Materials

10.2.1.1 Criterion Reference and Title

We-2.1: No Hazardous Materials

10.2.1.2 Criterion Type

Optional

10.2.1.3 Intent

To eliminate the exposure to toxic substances to secure both human health and environment.

10.2.1.4 General Requirements

To eliminate the exposure to all of the following hazardous materials in the project as indicated in Table 10.2.1-1:

Table 10.2.1-1. Hazardous Materials Requirements

Category	Requirements
Asbestos	The use of Asbestos Containing Materials (ACMs) is banned in New Buildings and in Existing Buildings as well. In case, ACMs were to be found in an Existing Building, they shall be removed as is required by remediation.
Lead or Heavy Metals	Paints and other building materials, containing lead or other heavy metals shall not be used unless the metal is encapsulated in a system such as a photovoltaic cell. As for paints, lead-free paints shall be used.
Mercury	Mercury shall not exist in building materials except specified fluorescent lamps with low mercury content and long lamp life.
Chromated Copper Arsenate (CCA)	No Chromated Copper Arsenate (CCA)-treated timber shall be used within the New and Existing Buildings.
Cadmium	No added cadmium-containing paints shall be used within the New and Existing buildings.

For New Building in Design Phase

If portions of the project are reused from an Existing building and contain hazardous materials, a removal and disposal plan at a hazardous waste facility shall be prepared as per international or local recognized standards.

For New Building in Construction Phase

To follow up and to verify that the removal and disposal plan prepared in the design phase is put in effect. To make sure that the portions of the project which are reused from an Existing building do not contain toxic substances.

For Existing Building

If hazardous materials exist in an existing building, international standards shall be followed to verify the removal and disposal of toxic substances at a hazardous waste facility.

10.2.1.5 Special Requirements

For Hospital sector

Lead used for both radiation shielding and MRI shielding in the hospital sector are exempted.

10.2.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.1-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications against the use of hazardous materials should be compliant with the criterion requirements.
Removal and Disposal Action Plan Preparation	• When portions of the project are reused from an Existing building, it is mandatory to submit the methodology which was implemented in preparing the removal of these hazardous materials and the disposal plan which followed.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from the Design Phase)
Manufacturers' Documentation	• The Product Material Safety Data Sheets (MSDS) and the Manufacturers' Documentation should indicate that every product is free of hazardous materials.
Removal and Disposal Action Plan Implementation	• Evidence of removal and disposal of toxic substances at a hazardous waste facility should be submitted if portions of the project are reused from an Existing building.

Submittal Name	Submittal Description
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	• The Product Material Safety Data Sheets (MSDS) and the Manufacturer Documentation should indicate that every product is free of hazardous materials.
Removal and Disposal Action Plan Implementation	• Evidence of removal and disposal of hazardous materials at a hazardous waste facility should be submitted if these materials were to be found in the renovation of an Existing building.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.1.7 Score Allocation

Note that this criterion is a prerequisite, which means that all the Criterion requirements shall be met in order to qualify for this criterion. The score for this criterion is determined based on the following score allocation table for each criterion requirement.

Table 10.2.1-3. Factor for Each Criterion Requirement

Parameters Requirements	Status	Factor "F"	
No Asbestos	Yes	F_1	1
	No		0
No Lead or Heavy Metals	Yes	F_2	1
	No		0
No Mercury	Yes	F_3	1
	No		0
No Chromated copper arsenate (CCA)	Yes	F_4	1
	No		0
No Cadmium	Yes	F_5	1
	No		0

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \ 100\ * \prod_{i=1}^{5} Fi$$

If the project includes at least one hazardous material, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if no hazardous materials are used in the project.

10.2.2 We-2.2: Adhesives and Sealants

10.2.2.1 Criterion Reference and Title

We-2.2: Adhesives and Sealants

10.2.2.2 Criterion Type

Optional

10.2.2.3 Intent

To use low-emitting adhesives and sealants (low VOC materials), to improve air quality, human health, Occupant productivity, and the environment.

10.2.2.4 General Requirements

Adhesives and sealants shall be chosen only if compliant with the VOC limits in **South Coast Air Quality Management District Rule 1168** as presented in Table 10.2.2-1.

Table 10.2.2-1. Maximum VOC Limits of Adhesives & Sealants (SCAQMD Rule 1168)

Category	VOC Limits (g/L)*
Adhesives	
Carpet Pad Adhesive	50
Ceramic Glass, Porcelain, and Stone Tile Adhesive	65
VCT and Asphalt Tile Adhesive	50
Cove Base Adhesive	50
Subfloor Adhesive	50
Rubber Floor Adhesive	60
Wood Flooring Adhesive	20
All Other Indoor Floor Covering Adhesives	50
All Other Outdoor Floor Covering Adhesives	150
Multi-Purpose Construction Adhesives	70
Roofing	200
Dry Wall and Panel Adhesive	50
Structural Glazing Adhesive	100
Structural Wood Member Adhesive	140
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Edge Glue Adhesive	250
ABS Welding Cement	325
CPVC Welding Cement	400
PVC Welding Cement	425
All Other Plastic Welding Cements	100

All Other Adhesives	250
Substrate Specific Adhesives	
Metal	30
Plastic Foams	50
Porous Material (except wood)	50
Wood	30
Fiberglass	80
Reinforced Plastic Composite	200
Adhesive Primers	
Plastic	550
Pressure Sensitive	250
All Other Adhesive Primers	250
Sealants	
Architectural Applications	250
Sealant Primers	
Architectural Applications Non-Porous	250
Architectural Applications Porous	775
Modified Bituminous	500
All Other Sealant Primers	750

* Maximum grams of VOC per liter of adhesive or sealant, less water and exempt compounds

To verify whether the adhesives and sealants used in the project are of low emission or high emission, a template shall be filled in the ARZ portal to check the compliance of each material. The total percentage, by volume, of adhesives and sealants compliant with VOC content (%) is equal to the volume of adhesives and sealants compliant with VOC content evaluation (L) over to the total volume of adhesives and sealants (L). It can be determined by the following equation:

$$\%\ compliant\ adhesives\ and\ sealants = 100 * \frac{Compliant\ volume\ of\ adhesives\ and\ sealants\ (L)}{Total\ volume\ of\ adhesives\ and\ sealants\ (L)}$$

10.2.2.5 Special Requirements

None

10.2.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.2-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications of low-emitting adhesives and sealants should be compliant with the criterion.
Schedule of Products	• The Schedule of Products of all compliant and non-compliant low-emitting adhesives and sealants should be provided.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from the Design Phase)
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Datasheets for low- emitting adhesives and sealants used in the project.
Tracking sheet	• The Tracking sheet should be signed by the construction managers upon receipt of all the adhesives and sealants.
The Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting adhesives and sealants.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Datasheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Datasheets for low- emitting adhesives and sealants used in the project.
Tracking sheet	• The Tracking sheet should be signed by the operations managers upon receipt of all the adhesives and sealants.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of

Submittal Name	Submittal Description
	all compliant and non-compliant low-emitting adhesives and sealants.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.2.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score\ (\%) = \ \%\ compiant\ adhesives\ and\ sealants$$

If all the adhesives and sealants used are non-compliant, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the adhesives and sealants used are compliant.

10.2.3 We-2.3: Paints and Coatings

10.2.3.1 Criterion Reference and Title

We-2.3: Paints and Coatings

10.2.3.2 Criterion Type

Optional

10.2.3.3 Intent

To use low-emitting paints and coatings (low VOC materials) to improve air quality, human health, Occupant productivity, and the environment.

10.2.3.4 General Requirements

Interior paints and coatings in the project shall be equal or less than the maximum Volatile Organic Compounds (VOC) limit values in **European Directive 2004/42/CE: 2004** (Phase II) and presented in Table 10.2.3-1.

Table 10.2.3-1. Maximum VOC Limits of Paints & Coatings (European Directive 2004/42/CE: 2004)

Product Category	**Type****	**VOC Limits (g/L)***
Interior Matte Walls and Ceilings (Gloss <25 @60º)	WB SB	30 30
Interior Glossy Walls and Ceilings (Gloss >25 @60º)	WB SB	100 100
Exterior Walls of Mineral Substrate	WB SB	40 430
Interior/Exterior Trim and Cladding Paints for Wood and Metal	WB SB	130 300
Interior/Exterior Trim Varnishes and Wood Stains, Including Opaque Wood Stains	WB SB	130 400
Interior and Exterior Minimal Build Wood Stains	WB SB	130 700
Primers	WB SB	30 350
Binding Primers	WB SB	30 750
One-Pack Performance Coatings	WB SB	140 500
Two-Pack Reactive Performance Coatings for Specific End Use (e.g., floors)	WB SB	140 500
Multi-Colored Coatings	WB SB	100 100

Decorative Effect Coatings	WB SB	200 200

*g/l of ready to use product

** WB = Water-based, SB = Solvent-based

To verify whether the paints and coatings used in the project are of low emission or high emission, a template shall be filled on the ARZ portal to check the compliance of each material.

The total percentage, by volume, of paints and coatings compliant with Volatile Organic Compounds (VOC) content (%) is equal to the volume of paints and coatings compliant with VOC content evaluation (L) over to the total volume of paints and coatings (L). It can be determined by the following equation:

$$\%\ compliant\ Paints\ and\ Coatings = 100 * \frac{Compliant\ volume\ of\ Paints\ and\ Coatings\ (L)}{Total\ volume\ of\ Paints\ and\ Coatings\ (L)}$$

10.2.3.5 Special Requirements

None

10.2.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.3-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications of low-emitting paints and coatings should be compliant with the criterion.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting paints and coatings.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from the Design Phase)
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical

Submittal Name	Submittal Description
	Data Sheets for low- emitting paints and coatings used in the project.
Tracking sheet	• The Tracking sheet should be signed by the construction managers upon receipt of all paints and coatings.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting paints and coatings.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Data Sheets for low- emitting paints and coatings used in the project.
Tracking sheet	• The Tracking sheet should be signed by the construction managers upon receipt of all paints and coatings.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting paints and coatings.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.3.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score\ (\%) = \%\ complint\ Paints\ and\ Coatings$$

If all paints and coatings used are non-compliant paints and coatings, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the paints and coatings used are compliant.

10.2.4We-2.4: Wood Resins

10.2.4.1 Criterion Reference and Title

We-2.4: Wood Resins

10.2.4.2 Criterion Type

Optional

10.2.4.3 Intent

To use low-emitting wood resins with low-Volatile Organic Compounds (VOC) materials to improve air quality, human health, Occupant productivity, and the environment.

10.2.4.4 General Requirements

The wood resin used in composite wood and Agri fiber products, such as Urea-Formaldehyde (UF), Melamine-Modified Urea Formaldehyde (MUF), and Phenol-Formaldehyde (PF) are the main source of formaldehyde emission. Composite wood and Agri fiber products used in internal construction materials and furniture shall not exceed formaldehyde VOC content class E1 levels of European Standard **EN 13986**.

Table 10.2.4-1. Formaldehyde Limits from Wood Based Panels According to European Standard EN 13986

Board Type	Limit value for formaldehyde release	Test method
Particle Board (PB), Medium Density Fiberboard (MDF) Oriented Strand Boards (OSB), Plywood (PLY)	≤0.124 mg/m³ air (0.099 ppm)	EN 717-1- Chamber
	≤8.0 mg/100g oven dry board	EN 120 - Perforator
	≤3.5 mg/m²h	EN 717-2- Gas analysis

The composite wood product category includes particleboards, medium density fiberboards, hardwood plywood boards with veneer, and structural wood panels or structural wood products.

Many alternatives to composite wood are available, including salvaged wood, Oriented Strand Board (OSB), and certified wood.

To verify whether the wood resins used in the project are of low emission or high emission, a template shall be filled in the ARZ portal to check the compliance of each material.

The ratio of the surface area of the wood compliant with VOC evaluation, inherently non-emitting sources criteria, or salvaged and reused materials criteria (m²) over the total surface area of the wood (m²) is equal to the percentage of compliant wood. It can be determined by the following equation:

$$\%\ compliant\ Wood\ =\ 100\ *\frac{Compliant\ surface\ of\ Wood\ (\mathrm{m}^2)}{Total\ surface\ of\ Wood\ \ (\mathrm{m}^2)}$$

10.2.4.5 Special Requirements

None

10.2.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.4-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications of low-emitting wood resins should be compliant with the criterion.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting wood resins.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from the Design Phase)
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Data Sheets for low- emitting Wood Resins used in the project.
Tracking sheet	• The Tracking sheet should be signed by the construction managers upon receipt of the wood resins.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting wood resins.

Submittal Name	Submittal Description
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Data Sheets for low- emitting material wood resins used in the project.
Tracking sheet	• The Tracking sheet should be signed by the construction managers upon receipt of all wood resins.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting wood resins.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.4.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score\ (\%) = \%\ \ compliant\ Wood$$

If all the wood used is non-compliant wood, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the wood used is compliant wood.

10.2.5 We-2.5: Ceiling Materials

10.2.5.1 Criterion Reference and Title

We-2.5: Ceiling Materials

10.2.5.2 Criterion Type

Optional

10.2.5.3 Intent

To use low-emitting ceiling materials (low-VOC materials) to improve air quality, human health, Occupant productivity, and the environment.

10.2.5.4 General Requirements

Ceiling systems shall comply with the requirements of **EN 13964: 2014** or equivalent compliant standard to not exceed formaldehyde VOC content class E1 levels evaluation, and be tested, classified and appropriately marked.

Table 10.2.5-1. Formaldehyde release Class E1 according to BS EN 13964: 2014

Board Type	Limit value for formaldehyde release	Test method
Particle Board (PB), Medium Density Fiberboard (MDF), Oriented Strand Boards (OSB), Plywood (PLY)	≤0.124 mg/m³ air (0.099 ppm)	EN 717-1- Chamber
	≤8.0 mg/100g oven dry board	EN 120 - Perforator
	≤3.5 mg/m²h	EN 717-2- Gas analysis

Wood ceiling systems and finishes shall comply with the requirements of **EN 13986:2004** or shall be equivalent to, or not exceed 5 ppm (parts per million) for Pentachlorophenol (PCP) content, and not exceed formaldehyde VOC content class E1 levels evaluation, and be tested, classified and appropriately marked.

The ceilings come in different types and use various products. This category ceiling products includes all ceiling panels; ceiling tiles; surface ceiling structures, such as gypsum or plaster; suspended systems, including canopies and clouds; and glazed skylights.

Salvaged and reused materials exposed to ambient condition for more than one year is considered compliant.
Products which are from inherently non-emitting sources are also considered compliant.

To verify whether the ceiling materials used in the project are of low emission or high emission, a template shall be filled in the ARZ portal to check the compliance of each material.

The ratio of the surface area of the ceiling materials compliant with VOC evaluation, inherently non-emitting sources criteria, or salvaged and reused materials criteria (m²) over the total surface area of the ceiling (m²) is equal to the percentage of the compliant ceiling. It can be determined by the following equation:

$$\%\ compliant\ Ceiling\ =\ 100\ *\frac{Compliant\ surface\ of\ Ceiling\ (\mathrm{m}^2)}{Total\ surface\ of\ Ceiling\ \ (\mathrm{m}^2)}$$

10.2.5.5 Special Requirements

None

10.2.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.5-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications of low-emitting ceiling materials should be compliant with the criterion.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting ceiling materials.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from the Design Phase)
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Data Sheets for low- emitting ceiling materials used in the project.

Submittal Name	Submittal Description
Tracking sheet	- The Tracking sheet should be signed by the construction managers upon receipt of all ceiling materials.
Schedule of Products	- A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting ceiling materials.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	- The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Data Sheets for low- emitting ceiling materials used in the project.
Tracking sheet	- The Tracking sheet should be signed by the construction managers upon receipt of all ceiling materials.
Schedule of Products	- A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting ceiling materials.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.5.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criteron\ Score\ (\%) =\ \%\ \ compliant\ Ceiling$$

If all ceilings used are non-compliant ceiling materials, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the ceiling materials used are compliant.

10.2.6 We-2.6: Flooring Materials

10.2.6.1 Criterion Reference and Title

We-2.6: Flooring Materials

10.2.6.2 Criterion Type

Optional

10.2.6.3 Intent

To use low-emitting materials for the flooring (low VOC materials) to improve air quality, human health, Occupant productivity, and the environment.

10.2.6.4 General Requirements

Hard flooring systems and finishes shall achieve **FloorScore Certification** or **Greenguard Indoor Air Quality Certification** for low product emission.

Wood flooring systems and finishes shall comply with the requirements of **EN 14342:2005** to not exceed 5 ppm (parts per million) for Pentachlorophenol (PCP) content and to not exceed formaldehyde VOC content class E1 levels evaluation, and be tested, classified and appropriately marked.

Resilient textile and floor covering (e.g., vinyl, linoleum, cork, rubber) shall meet or exceed the requirements of **EN 14041:2004** or equivalent compliant standard.

Carpet and carpet cushion shall comply with the **CRI Green Label** or **Green Label Plus Program** or **Greenguard Indoor Air Quality Certification Program** or **EN 14041:2004** or equivalent for Carpets.

The flooring product category includes all types of hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), raised flooring, wall base, underlayment, and other floor coverings.

Salvaged and reused materials exposed to ambient condition for more than one year is considered compliant.

Inherently non-emitting sources products are also considered compliant.

To verify whether the flooring materials used in the project are of low emission or high emission, a template shall be filled in the ARZ portal to check the compliance of each material.

The ratio of the surface area of the flooring materials compliant with VOC evaluation, inherently non-emitting sources criteria, or salvaged and reused materials criteria (m^2) over the total surface area of the flooring (m^2) is equal to the percentage of compliant flooring. It can be determined by the following equation:

$$\% \ compliant\ Flooring = 100 * \frac{Compliant\ surface\ of\ Flooring\ (\mathrm{m}^2)}{Total\ surface\ of\ Flooring\ \ (\mathrm{m}^2)}$$

10.2.6.5 Special Requirements

None

10.2.6.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.6-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications of low-emitting flooring materials should be compliant with the criterion.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting flooring materials.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from the Design Phase)
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Data Sheets for low- emitting flooring materials used in the project.
Tracking sheet	• The submitted Tracking Sheet should be signed by the construction managers upon receipt of all flooring.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting flooring materials.
Existing Building	

Submittal Name	Submittal Description
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	- The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Data Sheets for low- emitting flooring materials used in the project.
Tracking sheet	- The Tracking sheet should be signed by the construction managers upon receipt of all flooring.
Schedule of Products	- A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting flooring materials.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.6.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score\ (\%) = \%\ compliant\ Flooring$$

If all flooring materials used are non-compliant flooring materials, the score for this criterion will be 0%. A project earns a score 100% for this criterion if all flooring systems and finishes are compliant flooring materials.

10.2.7We-2.7: Wall Panels

10.2.7.1 Criterion Reference and Title

We-2.7: Wall Panels

10.2.7.2 Criterion Type

Optional

10.2.7.3 Intent

To use low emitting wall panels (low VOC materials) to improve air quality, human health, Occupant productivity, and the environment.

10.2.7.4 General Requirements

Wall panels and wall coverings for internal walls shall comply with the requirements of **EN 233:1999, EN 234:1997** and **EN 259-1:2001**.

Wood wall panels for internal walls shall comply with the requirements of **EN 13986** to not exceed formaldehyde VOC content class E1 levels evaluation, and be tested, classified and appropriately marked.

Table 10.2.7-1. Formaldehyde Release Class E1 According to EN 13986

Board Type	Limit value for formaldehyde release	Test method
Particle Board (PB), Medium Density Fiberboard (MDF) Oriented Strand Boards (OSB), Plywood (PLY)	≤0.124 mg/m^3 air (0.099 ppm)	EN 717-1- Chamber
	≤8.0 mg/100g oven dry board	EN 120 - Perforator
	≤3.5 mg/m^2h	EN 717-2- Gas analysis

The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, interior and exterior doors, wall frames, interior and exterior windows, and window treatments.

Salvaged and reused materials exposed to ambient condition for more than one year are considered compliant.
Inherently non-emitting sources products are also considered compliant.

To verify whether the wall panels used in the project are of low emission or high emission, a template shall be filled in the ARZ portal to check the compliance of each material.

The ratio of the surface of wall panels compliant with VOC evaluation, inherently non-emitting sources criteria, or salvaged and reused materials criteria (m²) over the total surface area of wall panels (m²) is equal to the percentage of compliant wall panels. It can be determined by the following equation:

$$\%\ compliant\ Wall\ Panels\ = 100 * \frac{Compliant\ surface\ of\ Wall\ Panels\ (\mathrm{m}^2)}{Total\ surface\ of\ Wall\ Panels\ \ (\mathrm{m}^2)}$$

10.2.7.5 Special Requirements

None

10.2.7.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.7-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications of low-emitting wall panels should be compliant with the criterion.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting wall panels.
New Building in Construction Phase	
Criterion Narrative	• Updated brief narrative (if different from the Design Phase)
Manufacturers Documentation	• The Manufacturers’ Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Datasheets for low- emitting wall panels used in the project.
Tracking sheet	• The Tracking sheet should be signed by the construction managers upon receipt of all wall panels.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting wall panels.

Submittal Name	Submittal Description
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Datasheets for low- emitting wall panels used in the project.
Tracking sheet	• The Tracking sheet should be signed by the construction managers upon receipt of all wall panels.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting wall panels.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.7.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score\ (\%) = \%\ compliant\ Wall\ Panels$$

If all wall panels used are non-compliant wall panels, the score for this criterion will be 0%. A project earns a score of 100% if all wall panels used are compliant with the criterion requirements.

10.2.8 We-2.8: Insulation

10.2.8.1 Criterion Reference and Title

We-2.8: Insulation

10.2.8.2 Criterion Type

Optional

10.2.8.3 Intent

To use low emitting insulation (low formaldehyde VOC materials) to improve air quality, human health and Occupant productivity, and the environment.

10.2.8.4 General Requirements

The insulation shall not contain any added formaldehyde, including urea formaldehyde, phenol formaldehyde, and urea-extended phenol formaldehyde.

The insulation must be tested and deemed compliant in accordance with ISO 16000-3: 2010, ISO 16000-6: 2011, ISO 16000-9: 2006, ISO 16000-11:2006 or equivalent.

The insulation product category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation.

Products which are essentially non-emitting sources of VOCs are considered compliant without testing.

To verify whether the insulation materials used in the project are of low emission or high emission, a template shall be filled in the ARZ portal to check the compliance of each material. The ratio of the surface area of insulation materials compliant with VOC evaluation, inherently non-emitting sources criteria, or salvaged and reused materials criteria (m^2) over the total surface area of insulation (m^2) is equal to the percentage of compliant insulation. It can be determined by the following equation:

$$\%\ compliant\ Insulation\ =\ 100 * \frac{Compliant\ surace\ of\ Insulation\ (\mathrm{m}^2)}{Total\ surface\ of\ Insulation\ \ (\mathrm{m}^2)}$$

10.2.8.5 Special Requirements

None

10.2.8.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.2.8-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications of low-emitting insulation materials should be compliant with the criterion.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting insulation materials.
New Building in Construction Phase	
Criterion Narrative	• The updated brief narrative (if different from the Design Phase)
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Datasheets for low- emitting insulation materials used in the project.
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting insulation materials.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturers' Documentation	• The Manufacturers' Documentation should include on the one hand, the product information such as the Material Safety Data Sheets (MSDS), the third-party certifications, and the testing reports, and on the other hand the Technical Datasheets for low- emitting insulation materials used in the project.

Submittal Name	Submittal Description
Schedule of Products	• A template for low-emitting materials on the ARZ portal should be filled in with the updated schedule of products of all compliant and non-compliant low-emitting insulation materials.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.2.8.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score\ (\%) = \%\ compliant\ Insulation$$

If all insulation materials used are non-compliant, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all insulation materials used are compliant.

10.3 Family: Management and Operations

10.3.1 We-3.1: Wellness Management Procedures

10.3.1.1 Criterion Reference and Title

We-3.1: Wellness Management Procedures

10.3.1.2 Criterion Type

Optional

10.3.1.3 Intent

To ensure safe and quality of living in the built environment.

10.3.1.4 General Requirements

Develop Operations and Maintenance manuals and a Maintenance Regime for each of the following wellness requirements:

- Air Quality
- Water Quality
- Light Quality
- Safety

Include at least the following job plans with the following minimum requirements and maximum frequencies, whenever such systems are installed at the Facility:

Air Quality

- Clean aluminum air pre-filters regularly (at least annually).
- Replace (not clean) disposable pleated air filters regularly (at least annually).
- Replace bag air filter bags regularly (at least annually).
- Initiate air filter cleaning and replacement after a sandstorm or any similar contaminating event.
- Clean the cooling or heating coils regularly (at least annually).
- Clean the drain pans regularly (at least annually).
- Clean the air outlets regularly (at least annually).
- Inspect and clean ventilation and air conditioning ducts regularly.

Water Quality

- Inspect water storage tanks annually for algae growth, sedimentation, and dirt. Clean as needed.
- Add chlorine or bleach to stored water at acceptable limits.
- Measure the chlorine levels at the nearest points of use to the water tank monthly, and make sure their levels are within the acceptable range.
- Measure the chlorine levels at the farthest points of use from the water tank monthly, and make sure their levels are within the acceptable range.
- Test water quality, including germicides, at the farthest points of use from water tanks annually, and make sure that the readings are within an acceptable range.

Light Quality

- Clean light fixtures from dust accumulation annually.
- Measure light levels at working height annually and replace lamps when light levels are low.

Fire Exits

- Label fire exits clearly with illuminated signage.
- Keep fire exits clear of obstacles.
- Lock fire exits and make sure they can be opened in one operation.

Fire Extinguishers

- Make Fire Extinguishers (FEs) available at the Facility.
- Inspect FEs monthly.
- Make a specialized workshop to operate, test, and refill FEs annually.

Water Sprinklers

- Inspect firefighting system pressure gauges monthly.
- Conduct a Zone Control Valves drain test quarterly and confirm operation of flow alarm devices.
- Practice opening and closing all valves annually and confirm the supervision switches operation.
- Check the Fire Department Connection (FDC)annually, and confirm the ability to access and to connect with the Fire Department.

Fire Pumps

- Operate electric fire pumps for 10 minutes weekly.

- Operate diesel fire pumps for 30 minutes weekly.
- Test all fire pumps annually at the minimum flow, the rated flow, and the maximum flow. Verify the performance against the original pump curve.

Other Fire Fighting Systems (e.g., FM200, CO2, etc.)

- Firefighting systems such as FM200, CO2 or other similar systems are available at the Facility.
- These systems are inspected monthly.
- Each system discharge and releasing circuit is simulated annually.
- Each cylinder pressure and weight is verified annually.

Fire Alarm

- Inspect the fire alarm panel weekly.
- Test the interface equipment with the fire alarm (e.g., elevators, smoke dampers, staircase pressurization fans, etc.) quarterly.

Emergency Lights

- Inspect the emergency lights quarterly.
- Verify the emergency light battery backup autonomy annually.

Lightning Protection System

- Inspect the lightening protection system quarterly.
- Test the lightening protection annually.

Earthing Distribution

- Test the earthing system annually.

Elevators

- Have the elevators inspected monthly by an expert maintenance provider.
- Test the emergency device annually.
- Have the elevators certified by a third party annually.

Demonstrate that maintenance is being applied as per the maintenance regime. The maintenance regime must be executed, and the Facility has documented evidence for that. At a minimum, Job Plans and check lists shall be completed, dated and signed by the maintenance supervisor. The jobs and dates must reflect the tasks and frequencies as dictated by the maintenance regime.

New Building
Provide a commitment to submit necessary records to LGBC for three consecutive years, starting no later than the date of applying for certification.
Existing Building
Provide LGBC with necessary records for three consecutive years. These could be three post-certification years, the past three years, if available, or any combination of past and future years provided they are consecutive.
In case of a post-certification record submittal, a prior binding commitment to LGBC is required.

Operations and Maintenance Manuals

Develop Operations and Maintenance (O&M) manuals for each of the above systems, where applicable.

The Operations and Maintenance (O&M) manuals are pivotal to enable the Operations and Maintenance team to provide the needed preventive, corrective, and predictive maintenance to the installed systems. Their purpose is to consolidate and explain what systems are installed, how they are configured, operated, and maintained. [3]

The Operations and Maintenance (O&M) manuals shall include, at a minimum, the following data: [3]

- As- built drawings and approved material submittals
- Original Equipment Manufacturer (OEM) Engineering manuals, Operations and Maintenance manuals, Spare Parts manuals
- Installation requirements
- Start-up requirements
- Site Configuration Procedures are about how the systems must be configured in normal operation.
- Standard Operating Procedures (SOPs)
- Emergency Operating Procedures (EOPs) must be applied during a breakdown or other abnormal events to restore the operation as close as possible to design condition and stop further deterioration of the systems.
- Maintenance Regime as defined earlier.

- Studies (e.g., soils, structural, electrical, mechanical, breaker, circuit)
- Commissioning reports
- Warranty certificates, including any support agreements
- Systems’ sequence of operation
- Recommended spare parts inventory items.
- A process to continuously update the Operations and Maintenance manuals as changes are introduced to the system’s configuration, settings, etc., or after component replacement, repairs or similar interventions.

The above requirements for Operations and Maintenance manuals are common among the following criteria:
Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4

Computer-Aided Facility Management System (CAFM)

Implement a Computer-Aided Facility Management system to direct, control, and document the aforementioned maintenance activities at the Facility.

A Computer-Aided Facility Management system (CAFM) stores the Facility asset register, the maintenance activities, the utility meter readings, the historical breakdowns and repairs, and the upgrades and replacements. Therefore, the Computer-Aided Facility Management system (CAFM) forms a management information system for the Facility. [1]

The Computer-Aided Facility Management system (CAFM) shall have the following minimum requirements [1]:

- Asset Registry (Store information such as: main features, nameplate information, specifications, date in service, warranty details, vendors, etc.)
- Work Orders (planning jobs, allocating personnel, booking needed material and tools, and tracking costs)
- Preventive Maintenance (Scheduling and automatically issuing work orders once the period from last completion date is reached.)
- Emergency Work Orders
- Service Requests
- Inventory Control
- Reporting

The aforementioned requirements for Computer-Aided Facility Management system (CAFM) are common among the following criteria:
Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4

Additional Wellness Requirements

Where applicable, the Facility shall comply with the following requirements:

- All fresh air inlets (for mechanical ventilation) are equipped with bag filters.
- Roof / Outdoor water storage tanks are opaque, i.e., they do not allow sunlight to reach the water.
- A sand filter and a water softener are installed before the main storage water tank.
- Chlorine dosing pumps are installed and controlled by chlorine detectors.
- A 1-micron filter or UV lamp is installed at every drinking water outlet.
- Fire exits are clearly labeled with illuminated signage.
- Fire exits are not locked and can be opened in one operation.

10.3.1.5 Special Requirements

None.

10.3.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.3.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Maintenance Requirements	• The tender documents require that the wellness Job Plans, and the minimum required frequencies be developed by the contractor and included in the Operations and Maintenance manuals.
Operations and Maintenance (O&M)Manuals Requirements	• The requirements of the Operations and Maintenance (O&M) manuals shall be part of the tender documents.

Computer-Aided Facility Management System (CAFM) Requirements	• The tender documents should include a section for the Computer-Aided Facility Management system (CAFM) explaining how to meet the minimum requirements.
Design Drawings	• Demonstrate that the below requirements are included, where applicable: ○ All fresh air inlets (for mechanical ventilation) are equipped with bag filters. ○ Roof / Outdoor water storage tanks are opaque i.e., they do not allow sunlight to reach the water. ○ A sand filter and a water softener are installed before the main storage water tank. ○ Chlorine dosing pumps are installed and controlled by chlorine detectors. ○ A 1-micron filter or UV lamp is installed at every drinking water outlet. ○ Fire exits are clearly labeled with illuminated signage. ○ Fire exits are not locked and can be opened in one operation.
New Building in Construction Phase	
Criterion Narrative	• Criterion Narrative should give a brief description of the strategy implemented by the project team to meet this criterion requirements.
Asset List	• The comprehensive list of the assets related to the handling of the air, the storage and distribution of water, the lighting, the safety, the lightening protection, the earthing system, and the list of elevators should be provided.
Preventive Maintenance Job Plans and Frequencies	• Wellness-related Job Plans and frequencies.
Operations and Maintenance (O&M) Manuals	• The Operations and Maintenance (O&M) manuals for each of the aforementioned assets at the Facility should be provided.
Job Plans	• The executed Job Plans related to wellness shall be completed and dated by an inspector. A commitment to provide these Job Plans for three years after handover should made.
Computer-Aided Facility Management System (CAFM) Information	• The Computer-Aided Facility Management System (CAFM) information such as: name, version, and features which satisfy the minimum requirements should be provided.

Computer-Aided Facility Management System (CAFM) Generated Documents	• The Computer-Aided Facility Management System (CAFM) generated documents for the following: ○ Asset Registry, Work Order list, Inventory items list, PM Job ○ Plans and frequencies
As- built Drawings	• Demonstrate that the below requirements are executed, where applicable: ○ All fresh air inlets (for mechanical ventilation) are equipped with bag filters. ○ Roof / Outdoor water storage tanks are opaque, i.e., they do not allow sunlight to reach the water. ○ A sand filter and a water softener are installed before the main storage water tank. ○ Chlorine dosing pumps are installed and controlled by chlorine detectors. ○ A 1-micron filter or UV lamp is installed at every drinking water outlet. ○ Fire exits are clearly labeled with illuminated signage. ○ Fire exits are not locked and can be opened in one operation.
Existing Building	
Criterion Narrative	• Criterion Narrative should give a brief description of the strategy implemented by the project team to meet this criterion requirements.
Asset List	• The comprehensive list of the assets related to the handling of the air, the storage and distribution of water, the lighting, the safety, the lightening protection, the earthing system, and the list of elevators should be provided.
Preventive Maintenance Job Plans and Frequencies	• Wellness-related Job Plans and frequencies.
Operations and Maintenance (O&M) Manuals	• The Operations and Maintenance (O&M) manuals for each of the aforementioned assets at the Facility.
Job Plans	• The executed Job Plans related to wellness shall be completed and dated by an inspector. A commitment to provide these Job Plans for three years after handover should made.

Computer-Aided Facility Management System (CAFM) Information	• The Computer-Aided Facility Management System (CAFM) information such as: name, version, and features which satisfy the minimum requirements should be provided.
Computer-Aided Facility Management System (CAFM) Generated Documents	• The Computer-Aided Facility Management System (CAFM) generated documents for the following: Asset Registry, Work Order list, Inventory items list, PM Job Plans and frequencies
As- built Drawings	• Demonstrate that the below requirements are executed, where applicable: ○ All fresh air inlets (for mechanical ventilation) are equipped with bag filters. ○ Roof / Outdoor water storage tanks are opaque, i.e., they do not allow sunlight to reach the water. ○ A sand filter and a water softener are installed before the main storage water tank. ○ Chlorine dosing pumps are installed and controlled by chlorine detectors. ○ A 1-micron filter or UV lamp is installed at every drinking water outlet. ○ Fire exits are clearly labeled with illuminated signage. ○ Fire exits are not locked and can be opened in one operation.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.3.1.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 10.3.1-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Air Quality				

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Are all fresh air inlets (for mechanical ventilation) equipped with bag filters?	1	Yes / No	1 / 0	1
Are Aluminum air pre-filters cleaned regularly (at least annually)?	2	Yes / No	1 / 0	1
Are disposable pleated air filters replaced (not cleaned) regularly (at least annually)?	3	Yes / No	1 / 0	1
Are bag air filters replaced regularly (at least annually)?	4	Yes / No	1 / 0	1
Is the cleaning and replacement of air filters initiated after a sandstorm or any similar contaminating event?	5	Yes / No	1 / 0	1
Are cooling or heating coils cleaned regularly (at least annually)?	6	Yes / No	1 / 0	1
Are drain pans cleaned regularly (at least annually)?	7	Yes / No	1 / 0	1
Are air outlets cleaned regularly (at least annually)?	8	Yes / No	1 / 0	1
Are ventilation and air-conditioning ducts inspected regularly and cleaned?	9	Yes / No	1 / 0	1
Water Quality				
Are roof / outdoor water storage tanks opaque? (They do not allow sunlight to reach the water.)	10	Yes / No	1 / 0	1
Are a sand filter and a water softener installed before the main storage water tank?	11	Yes / No	1 / 0	1
Are chlorine dosing pumps installed and controlled by chlorine detectors?	12	Yes / No	1 / 0	1
Is a 1-micron filter or UV lamp installed at every drinking water outlet?	13	Yes / No	1 / 0	1

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Are water storage tanks inspected annually for algae growth, sedimentation, and dirt? Are they cleaned as needed?	14	Yes / No	1 / 0	1
Is chlorine or bleach added to stored water at acceptable limits?	15	Yes / No	1 / 0	1
Are the Chlorine levels at the nearest points of use to water tank measured monthly? Are they within the acceptable range?	16	Yes / No	1 / 0	1
Are the chlorine levels at the farthest points of use from the water tank measured monthly? Are they within the acceptable range?	17	Yes / No	1 / 0	1
Is the water quality, including germicides, at the farthest points of use from the water tank tested annually? Are the readings within the acceptable range?	18	Yes / No	1 / 0	1
Light Quality				
Are light fixtures cleaned from dust accumulation annually?	19	Yes / No	1 / 0	1
Are light levels at working height measured annually, and are lamps replaced when light levels are low?	20	Yes / No	1 / 0	1
Fire Exits				
Are the fire exits clearly labeled with illuminated signage?	21	Yes / No	1 / 0	1
Are the fire exits kept clear of obstacles?	22	Yes / No	1 / 0	1
Are the fire exits left unlocked and can they be opened in one operation?	23	Yes / No	1 / 0	1
Fire Extinguishers				

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Are Fire Extinguishers (FEs), available at the Facility?	24	Yes / No	1 / 0	1
Are (FEs) inspected monthly?	25	Yes / No	1 / 0	1
Are (FEs) operated, tested, and then refilled annually by a specialized workshop?	26	Yes / No	1 / 0	1
Water Sprinklers		Yes / No	1 / 0	
Are the firefighting system pressure gauges inspected monthly?	27	Yes / No	1 / 0	1
Is the zone control valves drain test conducted quarterly, and is the operation of the flow alarm devices confirmed?	28	Yes / No	1 / 0	1
Are all the valves practiced (opened and closed) annually, and the supervision switches operation is confirmed?	29	Yes / No	1 / 0	1
The Fire Department Connection (FDC) is checked annually, and the ability to access and to connect with the Fire Department is confirmed.	30	Yes / No	1 / 0	1
Fire Pumps				
The electric fire pumps are operated weekly for 10 min.	31	Yes / No	1 / 0	1
The diesel fire pumps are operated weekly for 30min.	32	Yes / No	1 / 0	1
All fire pumps are tested annually at a minimum flow, at a rated flow, and at a maximum flow. The performance is verified against the original pump curve.	33	Yes / No	1 / 0	1
Other Fire Fighting Systems (e.g., FM200, CO2, etc.)				

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Are firefighting systems such as FM200, CO2 or any other similar systems available at the Facility?	34	Yes / No	1 / 0	1
Are systems inspected monthly?	35	Yes / No	1 / 0	1
Is each system discharge and releasing circuit simulated annually?	36	Yes / No	1 / 0	1
Are each cylinder pressure and weight verified annually?	37	Yes / No	1 / 0	1
Fire Alarm				
Is the fire alarm panel inspected weekly?	38	Yes / No	1 / 0	1
Is the Interface Equipment with fire alarms such as elevators, smoke dampers, staircase pressurization fans, etc., tested quarterly?	39	Yes / No	1 / 0	1
Emergency Lights				
Are emergency lights inspected quarterly?	40	Yes / No	1 / 0	1
Is the emergency light battery backup autonomy verified annually?	41	Yes / No	1 / 0	1
Lightning Protection System				
Is the lightening protection system inspected quarterly?	42	Yes / No	1 / 0	1
Is the lightening protection tested annually?	43	Yes / No	1 / 0	1
Earthing Distribution				
Is the earthing system tested annually?	44	Yes / No	1 / 0	1
Elevators				
Are the elevators inspected monthly by an expert maintenance provider?	45	Yes / No	1 / 0	1
Is the emergency device tested annually?	46	Yes / No	1 / 0	1

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Are the elevators certified by a third party annually?	47	Yes / No	1 / 0	1

In order to determine the criterion score, the following formula is applied <u>only for the systems which are installed at the Facility</u>, or <u>else the system is omitted</u>:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{47}(F_i * WF_i)}{\sum_{i=1}^{47} WF_i}\right]$$

A project earns a score of 100% if every system installed at the Facility complies with the required parameters as follows:

- The minimum required wellness Job Plans are implemented at a frequency which is equal to or greater than the required frequency.
- The system's details are included in the Operations and Maintenance (O&M) manuals, and meet the indicated requirements.
- The wellness Job Plans are managed through a Computer-Aided Facility Management System (CAFM) and meet the indicated requirements.

10.3.2 We-3.2: Wellness Awareness

10.3.2.1 Criterion Reference and Title

We-3.2: Wellness Awareness

10.3.2.2 Criterion Type

Optional

10.3.2.3 Intent

To ensure that the safety and the quality of living in the built environment are the primary mission of the maintenance teams and the maintenance management.

10.3.2.4 General Requirements

Ensure that the maintenance employees and the maintenance contractors, collectively referred to as the maintenance teams, are conscious about the wellness pertaining to

- Air Quality
- Water Quality
- Light Quality
- Safety.

Train maintenance teams on the safety and quality job plans listed under We-3.1. Provide this training to all new maintenance employees and subcontractors, and offer it periodically, at least every other year.

The training shall be provided by a qualified individual or entity, who is certified in wellness, or Facility management, from an industry recognized certification body, or who holds a degree in Engineering and has a minimum of 8 years of experience in Facility management. Ensure that maintenance teams are trained to identify, report, and anticipate safety or health hazards.

The maintenance entity shall have certified personnel in indoor air quality, water quality, and fire protection. At least one person shall be certified in each of the aforementioned areas from a recognized certification body.

10.3.2.5 Special Requirements

None

10.3.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.3.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Training Program	• The outline of the training on Indoor Air Quality (IAQ), water quality, lighting quality, and fire protection/fire safety should be provided.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Training Program	• The outline of the training on Indoor Air Quality (IAQ), water quality, lighting quality, and fire protection /fire safety should be provided.
Trainer(s)	• The name and the qualifications of the trainer(s) should be provided.
Maintenance Teams' Training	• The topic and the content of each training session should be provided. • The attendance sheets of each training session should indicate the date and the scope of the training, and the name, the position, and the signature of each attendee.
Certification in Indoor Air Quality	• The name of the qualified maintenance individual, and his/her certification in Indoor Air Quality (IAQ) should be provided.
Certification in Water Quality	• The name of the qualified maintenance individual, and his/her certification in water quality should be provided.
Certification in Fire Safety	• The name of the qualified maintenance individual, and his/her certification in fire protection/ fire safety should be provided.
Existing Building	

Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Training Program	- The outline of the training on Indoor Air Quality (IAQ), water quality, lighting quality, and fire protection/fire safety should be provided.
Trainer(s)	- The name and the qualifications of the trainer(s) should be provided.
Training of Maintenance Teams	- The topic and the content of each training session - The attendance sheets of each training session should indicate the date and the scope of the training, and the name, the position, and the signature of each attendee.
Certification in Indoor Air Quality	- The name of the qualified maintenance individual, and his/her certification in Indoor Air Quality (IAQ) should be provided.
Certification in Water Quality	- The name of the qualified maintenance individual, and his/her certification in water quality should be provided.
Certification in Fire Safety	- The name of the qualified maintenance individual, and his/her certification in fire protection/ fire safety should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.3.2.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 10.3.2-2. Factors and Weight Factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Training of Operations and Maintenance Staff				

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Are the Operations and Maintenance staff / maintenance contractors trained on the following procedures?				
Indoor Air Quality (IAQ)maintenance procedures	1	Yes / No	1 / 0	1
Water quality maintenance procedures	2	Yes / No	1 / 0	1
Lighting quality maintenance procedures	3	Yes / No	1 / 0	1
Fire safety and fire protection systems’ maintenance procedures	4	Yes / No	1 / 0	1
Importance of Wellness				
Are the Operations and Maintenance staff / maintenance contractors retrained at least every 2yrs on the maintenance procedures pertaining to wellness?	5	Yes / No	1 / 0	1
Are the new recruits or contractors trained upon joining in on the maintenance procedures pertaining to wellness?	6	Yes / No	1 / 0	1
Do the training courses tackle the consequences of poor maintenance on wellness?	7	Yes / No	1 / 0	1
Does the Facility or any of its maintenance contractors have one or more individuals certified in Indoor Air Quality (IAQ)?	8	Yes / No	1 / 0	2
Does the Facility or any of its maintenance contractors have one or more individuals certified in water quality?	9	Yes / No	1 / 0	2

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Does the Facility or any of its maintenance contractors have one or more individuals certified in fire safety?	10	Yes / No	1 / 0	2

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{10}(F_i * WF_i)}{\sum_{i=1}^{10} WF_i}\right]$$

A project earns 100% by complying with each of the aforementioned requirements.

10.3.3We-3.3: Smoke Free Buildings

10.3.3.1 Criterion Reference and Title

We-3.3: Smoke Free Buildings

10.3.3.2 Criterion Type

Optional

10.3.3.3 Intent

To avoid or limit exposure of building occupants and indoor building components, including surfaces, ventilation air distribution systems, to Environmental Tobacco Smoke (ETS) in order to eliminate the health risks associated with it.

10.3.3.4 General Requirements

The criterion requires 2 main issues:

1. Impose a no-smoking policy inside the building.
2. Provide a dedicated outdoor smoking area, at least 7.5 meters away from indoor spaces, air intakes, or operable windows and doors, to avoid indoor air contamination with tobacco smoke. This outdoor area where no food or entertainment is provided shall be properly designated for that end by appropriate signage. These restrictions promote short smoking break times in these places.

Additional measures

To avoid air contamination from potential adjacent smoking areas/units within a Facility, an Applicant shall have his/her unit weather-stripped.
Where weather-stripping is required, the air tightness of the space enclosure shall be pressure-tested, and the air leakage rate shall not exceed 2L/s.m^2 (i.e., for each square meter of enclosure surface area) under a pressure differential of 75Pa. The enclosure surface area shall be calculated by adding the areas of all surfaces, including ceiling, floors, exterior walls, and all other partitions. [4]

10.3.3.5 Special Requirements

In residential buildings, residential units shall be weather-stripped to prevent leakage between residential units.

For hotels, unless smoking is prohibited in all indoor spaces, smoking shall be prohibited at least in all common areas. All guestrooms must be compartmentalized, and all penetrations in unit walls, ceilings, and floors, including air path connections to vertical shafts adjacent to smoking units must be properly sealed.

10.3.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.3.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Official Letter of the Project Owner's No-smoking Commitment	• The official letter shall include (1) a confirmation of the project's no-smoking policy and (2) a narrative about how this policy is going to be enforced on the building occupants.
No-smoking Policy Signage	• The layouts should clearly show the following: (1) The signage at all the building entrances should indicate that the Facility operates a strict no-smoking policy. (2) The no-smoking signage all around the building should deter visitors from smoking in the vicinity.
Drawings of Outdoor Designated Smoking Room	• The drawings should clearly show (1) the delimitation of the designated outdoor smoking area, and (2) the 7.5 meter-distance from the indoor spaces, the air intakes, or the operable windows and doors.
Drawings of Appropriate Signage in the Dedicated Smoking Area	• The drawings should show the signage indicating the smoking allowance within the dedicated smoking area only.
Weather-stripping Details of Applicant Unit(s)	• The drawings should show the deck-to-deck partitions, the sealed ceilings, etc. • The door schedule should demonstrate the weather-stripping for (1) the unit door(s) leading to the outside, and (2) the unit door(s) leading to the common hallways.
Result of the Differential Air Pressure	• As per the requirements of the specifications, the contractor should perform a differential air pressure test, the result of

Submittal Name	Submittal Description
Test for Units in Project Building	which shall be reported as proof of the effectiveness of the units' weather-stripping.
New Building in Construction Phase	
Criterion Narrative	• Criterion Narrative should give a brief description of the strategy implemented by the project team to meet this criterion requirements.
Official Letter of the Project Owner's No-smoking Commitment	• The official letter shall include (1) a confirmation of the project's no-smoking policy and (2) a narrative about how this policy is enforced on the building occupants.
No-smoking Policy signage	• The As-built Drawings and photos should clearly show the following: (1) The signage at all the building entrances should indicate that the Facility operates a strict no-smoking policy. (2) The no-smoking signage all around the building should deter visitors from smoking in the vicinity.
As-built Drawings and Photos of the Outdoor Designated Smoking Room	• The As-built drawings should clearly show (1) the delimitation of the designated outdoor smoking area, and (2) the 7.5 meter-distance from the indoor spaces, the air intakes, or the operable windows and doors.
As-built Drawings and Photos of the Appropriate Signage in the Dedicated Smoking Area	• The As-built drawings should show the signage indicating the smoking allowance within the dedicated smoking area only.
As-built Drawings and Photos of the Weather-stripping Details of Applicant Unit(s)	• The As-built Drawings should show the full-height walls, the sealed ceilings, etc. • The door schedule should demonstrate the weather-stripping for (1) the unit door(s) leading to the outside, and (2) the unit door(s) leading to the common hallways.
Result of the Differential Air Pressure Test for Units in Project Building	• As per the requirements of the specifications, the contractor should perform a differential air pressure test, the result of which shall be reported as proof of the effectiveness of the units' weather-stripping.
Existing Building	

Submittal Name	Submittal Description
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Official Letter of the Project Owner's No-smoking Commitment	• The official letter shall include (1) a confirmation of the project's no-smoking policy and (2) a narrative about how this policy is enforced on the building occupants.
No-smoking Policy Signage	• The As-built Drawings and photos should clearly show the following: (1) The signage at all the building entrances should indicate that the Facility operates a strict no-smoking policy. (2) The no-smoking signage all around the building should deter visitors from smoking in the vicinity.
As-built Drawings and Photos of the Outdoor Designated Smoking Room	• The As-built drawings should clearly show (1) the delimitation of the designated outdoor smoking area, and (2) the 7.5 meter-distance from the indoor spaces, the air intakes, or the operable windows and doors.
As-built Drawings and Photos of the Appropriate Signage Used in the Dedicated Smoking Area	• The As-built drawings should show the signage indicating the smoking allowance within the dedicated smoking area only.
As-built Drawings and Photos of the Weather-stripping Details of Applicant Unit(s)	• The As-built Drawings should show the full-height walls, the sealed ceilings, etc. • The door schedule should demonstrate the weather-stripping for (1) the unit door(s) leading to the outside, and (2) the unit door(s) leading to the common hallways.
Result of the Differential Air Pressure Test for Units in Project Building	• As per the requirements of the specifications, the contractor should perform a differential air pressure test, the result of which shall be reported as proof of the effectiveness of the units' weather-stripping.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.3.3.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
No Smoking Policy				
Does the Facility have a strict no-smoking policy? Does this policy prohibit smoking inside buildings, near entrances, outdoor air intakes, and operable windows?	1	Yes / No	1 / 0	1
Does the Facility enforce the no-smoking policy through disciplinary actions or fines?	2	Yes / No	1 / 0	1
Designated Outdoor Smoking Areas (DOSA)				
Does the Facility have Designated Outdoor Smoking Areas (DOSA) away from indoor spaces, air intakes, and operable windows and doors by at least 7.5 m?		Yes / No	1 / 0	
Is a diagram displayed to set the DOSA boundary?	3	Yes / No	1 / 0	1
Is proper signage in place to indicate the Designated Outdoor Smoking Areas (DOSA)?	4	Yes / No	1 / 0	1
Is food consumption prohibited in the Designated Outdoor Smoking Areas (DOSA)?	5	Yes / No	1 / 0	1
Is entertainment prohibited in the Designated Outdoor Smoking Areas (DOSA)?	6	Yes / No	1 / 0	1

Since parameters 1 and 2 are both mandatory, failing to comply with the requirements of both, or either one of them, has serious repercussions on the Applicant's overall criterion points (0%). He or She will lose them all. However, if the aforementioned parameters are fulfilled, 50% of the score will be achieved.

A Designated Outdoor Smoking Area (DOSA) shall be provided as an alternative location for smokers. However, the applicant shall ensure that this Designated Outdoor Smoking Area (DOSA) satisfies one or more of the four DOSA requirements, each of which is worth 12.5%. These requirements shall ensure that the dwell time in the DOSA is strictly limited. Smoking shall be, by no means, promoted even outside the building.

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{6}(F_i * WF_i)}{\sum_{i=1}^{6} WF_i}\right]$$

10.4 Family: Bonus

10.4.1 We-4.1: Computational Fluid Dynamics (CFD)

10.4.1.1 Criterion Reference and Title

We-4.1: Computational Fluid Dynamics (CFD)

10.4.1.2 Criterion Type

Optional

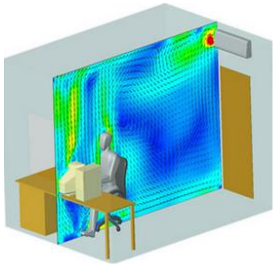
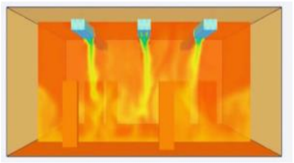
10.4.1.3 Intent

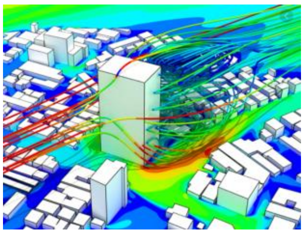
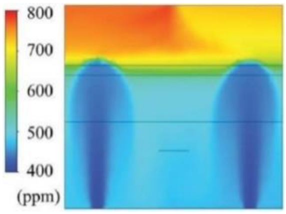
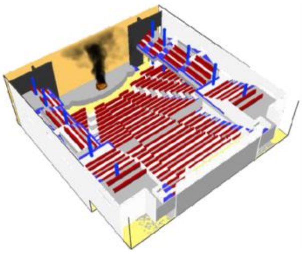
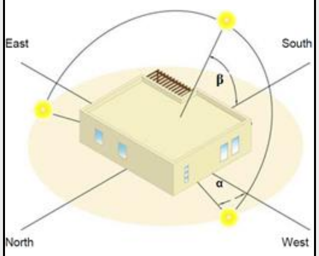
To promote the usage of fluid flow simulation (CFD) which enables architects and engineers to predict and optimize the performance of buildings in the early stage of the design process.

10.4.1.4 General Requirements

Computational Fluid Dynamics (CFD) simulation and analysis for the following applications in Architecture, Engineering and Construction (AEC) shall be performed by a qualified CFD expert who has a minimum of 5 years of experience in CFD simulation.

Table 10.4.1-1. CFD Applications for Architecture, Engineering and Construction (AEC)

Type	Case	Description
Thermal Comfort Analysis		Computational Fluid Dynamics (CFD) in thermal comfort analysis is one of the most useful methods to identify thermal perceptions of occupants in a building space, and to identify possible energy savings. The designer must analyze the thermal comfort, assess the dissatisfied percentage in a building, and measure variables such as temperature and flow speed at any point in the considered geometrical space.
HVAC Effectiveness Analysis		Computational Fluid Dynamics (CFD) can examine the effectiveness and the efficiency of various HVAC systems by easily changing the indoor HVAC unit location or the diffuser/grill types and locations, the supply air conditions and the system control schedules. This analysis can be performed in commercial buildings and data centers. CFD can help develop passive heating / cooling / ventilation

		strategies modelling, and optimizing building layouts.
Wind Analysis		Architects and engineers must predict the behavior of passive ventilation systems (Natural Ventilation) to model special phenomena, such as buoyancy due to temperature or humidity differences (Wind Analysis). They can also take into account virtually any geometrical feature so that innovative solutions can be tested and validated before prototyping or construction.
IAQ Analysis		The designer must consider the Indoor Air Quality (IAQ) analysis in a space where there are many sources of contaminant dispersion which affect the Indoor Air Quality (IAQ). CFD simulations must be performed to reduce the dispersion of contaminants in the indoor environment. The main sources are: • Contaminants (CO, CO2 and VOC) • Thermal Effects (Infiltration, Stratification, etc.) • Turbulence.
Fire Life Safety Analysis		Architects and engineers must ensure that a place is safe for its occupants under both normal and emergency conditions. For instance, for a place to be considered safe in a fire scenario, it must be equipped with the necessary safety systems such as smoke ventilation, pressurization systems, and sprinklers. CFD modelling maps the spread of fire and smoke through a detailed virtual representation of the building.
Orientation site and location Analysis		The designer must consider and prioritize all the factors and the site conditions affecting the building orientation. He or She must optimize the building site according to the local climate by predicting the distributions of air velocity, temperature, moisture, turbulence intensity, and contaminant concentration around the building. By doing so, the building groups can be effectively protected from adverse impacts of surrounding pollution, and outdoor pedestrian comfort can also be improved.

10.4.1.5 Special Requirements

None

10.4.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.4.1-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative describes: (1) The performed Computational Fluid Dynamics (CFD) analysis (2) The following requirements at a minimum ○ The executive summary ○ The building or Facility description ○ The CFD software used ○ The CFD application analysis description ○ The CFD modeling ○ The meshing and boundary conditions ○ The results, analysis and interpretation ○ The appendices.
CFD Expert Qualification	• The CFD expert must have a minimum of 5 years of experience in CFD simulation. • He or She must provide a reference list of earlier projects (with specific dates) as a proven track record of his or her experience with similar CFD simulations.
New Building in Construction Phase	
Criterion Narrative	• The updated brief narrative (if different from the Design Phase)
CFD Expert's Qualifications	• The updated Curriculum Vitae (CV) or resume of a qualified CFD Expert (if different from the Design Phase).
Existing Building	
Criterion Narrative	• The Criterion Narrative describes: (1) The performed Computational Fluid Dynamics (CFD) analysis (2) The following requirements at a minimum

Submittal Name	Submittal Description
	○ The executive summary ○ The building or Facility description ○ The CFD software used ○ The CFD application analysis description ○ The CFD modeling ○ The meshing and boundary conditions ○ The results, analysis and interpretation ● The appendices.
CFD Expert's Qualifications	● The CFD Expert must have a minimum of 5 years of experience in CFD simulation. ● He or She must provide a reference list of earlier projects (with specific dates) as a proven track record of his or her experience with similar CFD simulations.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.4.1.7 Score Allocation

The score for this criterion is determined based on the following score allocation table for each criterion requirement.

Table 10.4.1-3. Factors and Weight Factors for Each Criterion Requirement

Criterion Requirements	Status	Factor "F"		Weight Factor "WF"	
Thermal Comfort Analysis	Yes	F_1	1	WF_1	2
	No		0		2
HVAC Effectiveness Analysis	Yes	F_2	1	WF_2	3
	No		0		3
Wind Analysis	Yes	F_3	1	WF_3	2
	No		0		2
IAQ Analysis	Yes	F_4	1	WF_4	2
	No		0		2
Fire Life Safety Analysis	Yes	F_5	1	WF_5	2
	No		0		2
Site Orientation and Location Analysis	Yes	F_6	1	WF_6	1
	No		0		1

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \ 100 * \left[\frac{\left(\sum_{i=1}^{6} F_i * WF_i\right)}{\left(\sum_{i=1}^{6} \quad _i\right)} \right]$$

If no CFD analysis is performed, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the CFD applications for Architecture, Engineering and Construction (AEC), cited earlier, are performed in the project.

10.4.2 We-4.2: Indoor Air Quality Testing

10.4.2.1 Criterion Reference and Title

We-4.2: Indoor Air Quality Testing

10.4.2.2 Criterion Type

Optional

10.4.2.3 Intent

To improve and optimize the Indoor Air Quality (IAQ) of the building. The better the Indoor Air Quality (IAQ) is, the better the occupants' health and their quality of life becomes.

10.4.2.4 General Requirements

This criterion applies only to existing buildings. Indoor Air Quality (IAQ) testing should be conducted and reported by a qualified third-party IAQ auditor who has a minimum of 5 years of experience in IAQ auditing as per the standards mentioned in Table 10.4.2-1. By conducting Indoor Air Quality (IAQ) testing, the IAQ auditor would be able to provide testing results, suggest corrective actions, and make necessary recommendations to improve IAQ. The maximum concentration value of each contaminant shall not exceed the values mentioned in Table 10.4.2-2.

Table 10.4.2-1. IAQ International Standards

Standards	Title and Description
ISO 4224	Ambient air—Determination of carbon monoxide—Nondispersive infrared spectrometric method.
ISO 7708	Air quality—Particle size fraction definitions for health-related sampling.
ISO 13964	Air quality—Determination of ozone in ambient air—Ultraviolet photometric method.
ISO 16000-3	Indoor air: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air—Active sampling method.
ISO 16000-6	Indoor air: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS-FID.
ASTM D5197–09e1	Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology).

ASTM D5149–02	Standard Test Method for Ozone in the Atmosphere: Continuous Measurement by Ethylene Chemiluminescence.
U.S. EPA	U.S. EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air, IP-1: Volatile Organic Compounds, IP-3: Carbon Monoxide and Carbon Dioxide, IP-6: Formaldehyde and other aldehydes/ ketones, IP-10 Volatile Organic Compounds.

Table 10.4.2-2. Maximum Concentration Value of Each Contaminant

Contaminant			**Maximum Concentration**	**ISO Method**	**U.S. EPA and ASTM Methods**
Carbon monoxide (CO)			9 ppm; ≤2 ppm above outdoor levels	ISO 4224	EPA Compendium Method IP-3
Ozone (for buildings in EPA nonattainment areas for Ozone, or local equivalent)			0.075 ppm	ISO 13964	ASTM D5149 - 02
Total volatile organic compounds (TVOCs)			500 µg/m3 (200 µg/m3)*	ISO 16000-6	EPA TO-1, TO-17, or EPA Compendium Method IP-1
Particulates	**PM10** (for all buildings)		50 µg/m3 (20 µg/m3)*	ISO 7708	EPA Compendium Method IP-10
	PM2.5 (for buildings in EPA nonattainment areas for PM2.5, or local equivalent)		15 µg/m3		
Formaldehyde			27 ppb (16.3 ppb)*	ISO 16000-3	ASTM D5197, EPA TO-11 EPA Compendium Method IP-6
Target Volatile Organic Compounds	1	Acetaldehyde	140 µg/m3		
	2	Benzene	3 µg/m3	ISO 16000-3, ISO 16000-6	ASTM D5197; EPA TO-1, TO-17, or EPA Compendium Method IP-1
	3	Carbon disulfide	800 µg/m3		
	4	Carbon tetrachloride	40 µg/m3		
	5	Chlorobenzene	1000 µg/m3		
	6	Chloroform	300 µg/m3		
	7	Dichlorobenzene (1,4-)	800µg/m3		
	8	Dichloroethylene (1,1)	70 µg/m3		
	9	Dimethylformamide (N,N-)	80 µg/m3		
	10	Dioxane (1,4-)	3000 µg/m3		
	11	Epichlorohydrin	3 µg/m3		
	12	Ethylbenzene	2000 µg/m3		
	13	Ethylene glycol	400 µg/m3		
	14	Ethylene glycol monoethyl ether	70 µg/m3		
	15	Ethylene glycol monoethyl ether acetate	300 µg/m3		

	16	Ethylene glycol monomethyl ether	60 µg/m3		
	17	Ethylene glycol monomethyl ether acetate	90 µg/m3		
	18	Hexane (n-)	7000 µg/m3		
	19	Isophorone	2000 µg/m3		
	20	Isopropanol	7000 µg/m3		
	21	Methyl chloroform	1000 µg/m3		
	22	Methylene chloride	400 µg/m3		
	23	Methyl t-butyl ether	8000 µg/m3		
	24	Naphthalene	9 µg/m3		
	25	Phenol	200 µg/m3		
	26	Propylene glycol monomethyl ether	7000 µg/m3		
	27	Styrene	900 µg/m3		
	28	Tetrachloroethylene (Perchloroethylene)	35 µg/m3		
	29	Toluene	300 µg/m3		
	30	Trichloroethylene	600 µg/m3		
	31	Vinyl acetate	200 µg/m3		
	32	Xylenes, technical mixture (m-, o-, p-xylene)	700 µg/m3		

* The number between parentheses represents the maximum concentration value for hospitals only.
**ppb = parts per billion; ppm = parts per million; µg/m³ = micrograms per cubic meter.

The Indoor Air Quality (IAQ) testing should be conducted at least for the following contaminants:

- Carbon Monoxide (CO)
- Formaldehyde
- Particulate Matter (PM2.5 and PM10)
- Total Volatile Organic Compounds (TVOCs)
- 4-Phenylcyclohexane (4-PCH)
- Temperature
- Relative humidity.

The Indoor Air Quality (IAQ) assessment report shall be developed and shall meet the requirements identified in the ISO or ASTM methods, or any other equivalent method. The Indoor Air Quality (IAQ) assessment report could contain at a minimum the following outline:

1. Description of Indoor Air Quality (IAQ) Involved Parties and Testing Equipment

- Description of Indoor Air Quality team of professional experts
- Description of Indoor Air Quality testing equipment.

2. Indoor Air Quality (IAQ) Testing Procedure
    - Adopted Indoor Air Quality (IAQ) Standards and References
    - Collection of information through investigations, walkthroughs and survey questionnaires
    - Identification and selection of locations
    - The number of testing locations which includes all occupied spaces depends on the size of the building, and the number of ventilation systems.

3. Indoor Air Quality (IAQ) Sampling Methodologies
    - Description of the Indoor Air Quality (IAQ) method used for each contaminant

4. Corrective Measures, Recommendations and Conclusions

5. Appendices
    - Data collection sheets, checklists and calculations
    - Copies of different laboratory tests
    - Site drawings and building floor plans
    - Interview notes and checklists
    - All photographs from site visit
    - Description of measurement tools and data loggers’ datasheets
    - Terms and definitions.

Benefits of Healthy Indoor Air Quality (IAQ)
Since maintaining a safe commercial building is extremely important for business continuity, and is in the employees and clients’ best interest, it is worth considering then some of the benefits of good Indoor Air Quality (IAQ):

- Cleaner smell, reduced odors
- Lower energy costs
- Improved performance and productivity
- Decreased adverse health effects
- Decreased absence rates
- Increased comfort.

10.4.2.5 Special Requirements

This criterion is applicable only for Existing Buildings.

10.4.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.4.2-3. Required Submittals

Submittal Name	Submittal Description
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
IAQ Expert's Qualifications	• A qualified third-party Indoor Air Quality (IAQ) auditor who has a minimum of 5 years of experience in IAQ auditing. • Reference list of projects and dates of similar IAQ auditing performed by the same qualified IAQ Expert.
IAQ Assessment Plan	• The Indoor Air Quality (IAQ) assessment plan should describe at a minimum the following requirements: ○ Indoor Air Quality (IAQ) testing procedure ○ Indoor Air Quality (IAQ) sampling methodologies ○ Corrective measures, recommendations and conclusions ○ Appendices.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.4.2.7 Score Allocation

The score for this criterion is determined based on the following score allocation table for each criterion requirement.

$$riterion\ Score = 100 * F_1$$

If no Indoor Air Quality (IAQ) Testing is performed, $F_1 = 0$, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if Indoor Air Quality (IAQ) Testing is performed ($F_1 = 1$).

10.4.3 We-4.3: Health and Safety

10.4.3.1 Criterion Reference and Title

We-4.3: Health and Safety

10.4.3.2 Criterion Type

Optional

10.4.3.3 Intent

To provide occupants' safety and protect them from hazards, and to improve operational efficiency.

10.4.3.4 General Requirements

1. For New Building in Design Phase

The project delivery team can include a Fire and Life Safety Engineer, who has a minimum of 5 years of experience in fire protection and life safety design, or a qualified engineer who holds a health and safety certification from an industry recognized certification body. The Fire Safety Engineer or Health and Safety Engineer (HSE) should be involved in all the design phases, from planning to construction.

1.1. The design standards and guidelines for health and life safety (i.e., International Building Code and NFPA Standards, ISO Standards, or any other equivalent compliant standard) shall be adopted by the design team during the design planning, including the statutory requirements and the voluntary requirements, which address the owner's performance needs and requirements, and which cover, at a minimum, the following fields:

Emergency Preparedness

- Emergency plan & mock drills
- Display of emergency organogram and escape routes
- Emergency escape routes and evacuation procedures
- Emergency preparedness and response plans for (1) natural disasters, such as floods and earthquakes, and (2) man-made threats, such as bomb threats and civil disorders
- Availability of emergency equipment
- Emergency signage
- First-aid facilities.

1.2. Site Requirements

A quality site design will integrate performance requirements associated with the Fire Department access, suppression, and separation distances and site/building security.

1.2.1. Fire Department Access

a. Design buildings which enable firefighters to locate an area quickly.
b. Provide a rapid access to various requirements such as Fire Department Connections (FDCs), fire command center, fire alarm control equipment, fire pump room, hose valves, elevators and stairs, annunciators, key boxes, etc.
c. Accommodate the access of fire apparatus into and around the building site.
d. Comply with local authorities who have the jurisdiction to accommodate the access of fire apparatus into and around the building site, and to coordinate the access control point layout.

1.2.2. Fire hydrants

1.2.3. Coordinate with Security Measures

1.3. Building Construction Requirements

- Construction type, allowable height, and area
- Exposures/Separation requirements
- Fire ratings, materials, and systems
- Occupancy types
- Interior finish
- Exit enclosure

1.4. Life Safety

- Exit access paths
- Exit remoteness
- Exit discharge
- Areas of refuge
- Accessible exits
- Door-locking arrangements (security interface)
- Occupancy

1.5. Fire Detection and Notification System Requirements

- Detection system
- Mass notification
- Fire alarm notification
- Labels and distance requirements

1.6. Firefighting System Requirements

- Suppression System
- Portable Fire Extinguishers
- Automatic fire-extinguishing system
- Standpipes and Fire Department hose outlets
- Hydrant system, sprinkler system and fire hose reel system
- Passive Fire protection
- Maintenance practices of the Fire Protection System.

1.7. Special Fire Detection and Protection Requirements

- Engineered smoke control systems
- Special hazard systems
- Fireproofing and fire stopping
- Specific critical Facility needs.

1.8. Emergency Power, Lighting, and Exit Signage

- Emergency Lighting design
- Exit lighting design
- High-efficiency diesel generator and UPS backup availability design.

1.9. Gas System

- Protection of gas cylinders and tanks, and distance requirements
- Safety labels and signs
- Specific fire protection system for gas system design
- Gas detection system and alarm notification.

1.10. Electrical System

- Differential circuit breaker and surge protection device
- Earthing system design
- Lightning protection system design
- Electrical safety.

1.11. Security System

- Security system design
- Intruder alarm system design
- CCTV system design.

2. For New Building in Construction Phase

The project construction team must include a Health and Safety Engineer (HSE), who has a minimum of 5 years of experience in Health and Life Safety, or a qualified engineer who holds a Health and Life Safety certification from an industry recognized certification body. The Health and Safety Engineer (HSE) should be involved in all the construction phases, from construction to occupancy.

The construction standards and guidelines for Health and Life Safety (i.e.: Occupational Safety and Health Administration "OSHA" or any other equivalent standard) shall be adopted by the construction team, including the statutory requirements and the voluntary requirements, which address the owner's performance needs and requirements, and which cover, at a minimum, the following fields:

Construction Site Safety Requirements

Some of the issues which might be assessed during a safety audit include:

- Notices and signs are appropriate and located in clear, visible places.
- Zones and activities are effectively separated from one another.
- Access routes and walkways are well-demarcated.
- Hazardous substances are properly-contained.
- A health-and-safety plan is in place.
- First-aid equipment and first-aiders are available.
- There are processes for reporting On-site accidents and near-misses, and for learning from emerging issues.
- There is an effective emergency strategy in place.
- Evacuation routes are in place.
- Workers are provided with the appropriate Personal Protective Equipment (PPE).
- There are appropriate welfare facilities.
- There is provision in place for safety training, such as site inductions, toolbox talks, safety briefings, etc.
- The site boundary is secure.
- Appropriate lighting and security measures are in place.
- The site is relatively clear of debris, and the materials are appropriately stored.
- Safety is preserved in office areas.
- Housekeeping and storage practices are maintained.
- Facility utilities and services, such as an HVAC system, a Diesel generator set, and a UPS are secured.
- The contractors maintain safety measures while in operation.

- The management systems are in place to ensure that duties under CDM are fulfilled.
- The health-and-safety file is accurate and up-to-date.
- Safety trainings and regular meetings are held.
- The subcontractors' activities are conform to the health and safety requirements of the main contractor.

2.1. Provision of Safety Control Measures on Construction Sites

- Working at heights
- Plant and equipment
- Scaffolds
- Cranes
- Fall protection
- Ladders
- Mobile equipment
- Hazardous chemicals including fuel and oil
- Fire protection
- Personal Protective Equipment (PPE)
- Work environment
- Electrical power supply
- Lock out
- Environmental hazards
- Administrative procedures
- Hand and power tools
- Signs and barricades
- Welding, cutting, and grinding
- Excavation
- Concrete
- Steel erection
- Confined space.

2.2. Provision of Control Measures for Accidents on Construction Sites

- Provision of First-Aid
- Facility provision of helmet or hard hat
- Provision of protective clothes
- Provision of traction boots
- Provision of hand gloves

- Use of signs, guides, cautions, and reflectors
- Provision of goggles or eyewear
- Use of protective equipment
- Use of safety belts
- Use of safety net on scaffolds.

3. For Existing Building

The project operations team must include a Health and Safety Engineer (HSE), who has a minimum of 5 years of experience in Health and Life Safety. The Health and Safety Engineer (HSE) should be involved in all the phases of the existing building, from occupancy to operations and maintenance.

Operations and Maintenance standards and criteria for health and life safety (i.e., Occupational Safety and Health Administration "OSHA" or any other equivalent standard) shall be adopted by the Operations and Maintenance team, including the statutory requirements and the voluntary requirements, which address the owner's performance needs and requirements, and which cover, at a minimum, the following fields:

Existing Site Safety Requirements

Some of the issues which might be assessed during a safety audit include:

- Notices and signs are appropriate and located in clear, visible places.
- Zones and activities are effectively separated from one another.
- Access routes and walkways are well-demarcated.
- Hazardous substances are properly-contained.
- A health and safety plan is in place.
- First-aid equipment and first-aiders are available.
- There are processes for reporting On-site accidents and near-misses, and for learning from issues which emerge.
- There is an effective emergency strategy in place.
- Evacuation routes are in place.
- Workers are provided with the appropriate Personal Protective Equipment (PPE).
- There are appropriate welfare facilities.
- There is provision in place for safety training, such as site inductions, toolbox talks, safety briefings, etc.
- The site boundary is secure.
- Appropriate lighting and security measures are in place.
- The site is relatively clear of debris, and the materials are appropriately stored.
- Safety is preserved in office areas.

- Housekeeping and storage practices are maintained.
- Facility utilities and services, such as an HVAC system, a Diesel generator set, and a UPS are secured.
- The Existing and Maintenance staff maintain safety measures while in operation.
- The management systems are in place to ensure that duties under CDM are fulfilled.
- The health-and-safety file is accurate and up-to-date.
- Safety trainings and regular meetings are held.
- The existing staff team measures are conform with the health and safety requirements of the main operator.

3.1. Provision of Safety Control Measures on Existing Sites

- Working at heights
- Plant and equipment
- Scaffolds
- Cranes
- Fall protection
- Ladders
- Mobile equipment
- Hazardous chemicals including fuel and oil
- Fire protection
- Personal Protective Equipment (PPE)
- Work environment
- Electrical power supply
- LOCK OUT
- Environmental hazards
- Administrative procedures
- Hand and power tools
- Signs and barricades
- Welding, cutting, and grinding
- Excavation
- Concrete
- Steel erection
- Confined space.

3.2. Provision of Control Measures for Accidents on Existing Sites

- Provision of First-Aid

- Facility provision of helmet or hard hat
- Provision of protective clothes
- Provision of traction boots
- Provision of hand gloves
- Use of signs, guides, cautions, and reflectors
- Provision of goggles or eyewear
- Use of protective equipment
- Use of safety belt
- Use of safety net on scaffolds.

10.4.3.5 Special Requirements

This criterion is applicable only for Existing Building.

10.4.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.4.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative describes the factors to take into account when planning healthy and safe indoor and outdoor environments for occupants. It shall cover, at a minimum, the following requirements: ○ Executive summary ○ Building or Facility description ○ Health and life safety standards ○ Emergency preparedness ○ Site requirements ○ Building construction requirements ○ Life safety ○ Fire detection and notification system requirements ○ Special fire detection and protection requirements ○ Firefighting system requirements ○ Emergency power, lighting, and exit signage ○ Gas system ○ Electrical system (Earthing, lightning and power safety) ○ Security system ○ Appendices.

Submittal Name	Submittal Description
Qualifications	• The Qualifications of the Fire Safety Engineer or Health and Safety Engineer (HSE), who (1) has a minimum of 5 years of experience in Fire Protection and Life Safety, or (2) who holds a Health and Safety certification from an industry recognized certification body, should be provided.
Drawings Plan	• Life safety • Fire alarm system • Firefighting system • Smoke management system • Emergency power, lighting, and exit signage • Gas system • Electrical system (earthing, lightning, and power safety) • Security system
Specifications	• Specifications of the factors to be taken into account when planning healthy and safe indoor and outdoor environments for occupant and shall cover at a minimum the requirements cited in the Criterion Narrative.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative describes the factors to take into account when planning healthy and safe indoor and outdoor environments for occupants. It shall cover, at a minimum, the following requirements: ○ Executive summary ○ Building or Facility description ○ Health and life safety standards ○ Construction site safety requirements ○ Provision of safety control measures on construction sites ○ Provision of control measures for accidents on construction sites ○ Appendices.
Qualifications	• The Qualifications of the Fire Safety Engineer or Health and Safety Engineer (HSE), who has a minimum of 5 years of experience in Fire Protection and Life Safety, or who holds a Health and Safety certification from an industry recognized certification body, should be provided.
As-built Drawings	• The As-built which should be provided ○ Life safety ○ Fire alarm system

Submittal Name	Submittal Description
	○ Firefighting system ○ Smoke management system ○ Emergency power, lighting, and exit signage ○ Gas system ○ Electrical system (Earthing, lightning and power safety) ○ Security system.
Datasheets / Catalogs	• The Manufacturer Datasheets / catalogs for health and safety systems should be provided.
Existing Building	
Criterion Narrative	• Criterion Narrative describing the factors to take into account when planning healthy and safe indoor and outdoor environments for occupant and shall cover, at a minimum, the following requirements: ○ Executive summary ○ Building or facility description ○ Health and life safety standards ○ Existing site safety requirements ○ Provision of safety control measures on existing sites ○ Provision of control measures for accidents on existing sites ○ Appendices.
Qualifications	• The Qualifications of the Fire Safety Engineer or Health and Safety Engineer (HSE), who has a minimum of 5 years of experience in Fire Protection and Life Safety, or who holds a Health and Safety certification from an industry recognized certification body should be provided.
Facility Drawings	• The Facility Drawings which should be provided ○ Life safety ○ Fire alarm zones ○ Firefighting zones ○ Smoke management zones ○ Emergency power, lighting zones ○ Gas zones ○ Electrical zones ○ Security zones.
Facility Management Documentation	• The Facility Management Documentation for health and life safety should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.4.3.7 Score Allocation

For New Building in Design Phase

The score for this criterion is determined based on the following score allocation table for each criterion requirement.

Table 10.4.3-2. Factors and Weight Factors for Each Criterion Requirement of New Building in Design Phase

Criterion Requirements	Status	Factor "F"		Weight Factor "WF"	
The Health and Safety Engineer (HSE) designation	Yes	F_1	1	WF_1	1
	No		0		1
Design Standards for health and life safety	Yes	F_2	1	F_2	1
	No		0		1
Emergency preparedness	Yes	F_3	1	WF_3	4
	No		0		4
Site requirements	Yes	F_4	1	WF_4	3
	No		0		3
Building construction requirements	Yes	F_5	1	WF_5	3
	No		0		3
Life safety	Yes	F_6	1	WF_6	3
	No		0		3
Fire detection and notification system	Yes	F_7	1	WF_7	3
	No		0		3
Firefighting system	Yes	F_8	1	WF_8	3
	No		0		3
Special fire detection and protection	Yes	F_9	1	WF_9	3
	No		0		3
Emergency power, lighting, and exit signage	Yes	F_{10}	1	WF_{10}	3
	No		0		3
Gas system	Yes	F_{11}	1	WF_{11}	3
	No		0		3
Electrical system	Yes	F_{12}	1	WF_{12}	3
	No		0		3
Security system	Yes	F_{13}	1	WF_{13}	2
	No		0		2

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{13} F_i * WF_i)}{(\sum_{i=1}^{13} WF_i)}\right]$$

If no criterion requirement cited earlier is achieved, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the criterion requirements cited earlier are achieved in the project.

For New Building in Construction Phase

The score for this criterion is determined based on the following score allocation table for each criterion requirement.

Table 10.4.3-3. Factors and Weight Factors for Each Criterion Requirement of New Building in Construction Phase

Criterion Requirements	Status	Factor "F"		Weight Factor "WF"	
The Health and Safety Engineer (HSE) Designation	Yes	F_1	1	WF_1	1
	No		0		1
Construction Standards for Health and Life Safety	Yes	F_2	1	WF_2	1
	No		0		1
Construction Site Safety Requirements	Yes	F_3	1	WF_3	5
	No		0		5
Provision of Safety Control Measures on Construction Sites	Yes	F_4	1	WF_4	4
	No		0		4
Provision of Control Measures for Accidents on Construction Sites	Yes	F_5	1	WF_5	3
	No		0		3

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{5} F_i * WF_i)}{(\sum_{i=1}^{5} WF_i)}\right]$$

If no criterion requirement cited earlier is achieved, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the criterion requirements cited earlier are achieved in the project.

For Existing Building

The score for this criterion is determined based on the following score allocation table for each criterion requirement.

Table 10.4.3-4. Factors and Weight Factors for Each Criterion Requirement of Existing Building

Criterion Requirements	**Status**	**Factor "F"**		**Weight Factor "WF"**	
The Health and Safety Engineer Designation	Yes	F_1	1	WF_1	1
	No		0		1
Operations and Maintenance Standards for Health and Life Safety	Yes	F_2	1	WF_2	1
	No		0		1
Existing Site Safety Requirements	Yes	F_3	1	WF_3	5
	No		0		5
Provision of Safety Control Measures on Existing Sites	Yes	F_4	1	WF_4	4
	No		0		4
Provision of Control Measures for Accidents on Existing Sites	Yes	F_5	1	WF_5	3
	No		0		3

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\left(\sum_{i=1}^{5} F_i * WF_i\right)}{\left(\sum_{i=1}^{5} WF_i\right)}\right]$$

If no criterion requirement cited earlier is achieved, the score for this criterion will be 0%. A project earns a score 100% for this criterion if all the criterion requirements cited earlier are achieved in the project.

10.4.4We-4.4: Innovation

10.4.4.1 Criterion Reference and Title

We-4.4: Innovation

10.4.4.2 Criterion Type

Optional

10.4.4.3 Intent

To support innovation and new solutions which lead to an improvement in occupants' wellness, and which are not rewarded by the standard ARZ criteria.

10.4.4.4 General Requirements

Demonstrate any new smart solution, technology, invention, design, construction, operation, maintenance or demolition method or process which is not covered in ARZ 2.0, and which proves to be effective in terms of ensuring the occupants' wellness. The innovation must be approved by LGBC during the official rating of the submitted application. The innovation must be significant, achievable, and measurable by identifying the following:

- The intent of the proposed innovation criterion
- The proposed general and special requirements for compliance
- The proposed required submittals to demonstrate compliance.

Up to a maximum of 5 innovation items are available in aggregate from a combination of the following:

5) Approved Innovation

One or several credits can be awarded for each innovation application form approved by LGBC after the submittal review process.

6) Exemplary Level of Performance in ARZ Criteria in the Wellness Module

The project demonstrates exemplary performance if one or more of the following ARZ assessment criteria are met at an exemplary level of performance: We-3.1 Wellness Management Procedures

10.4.4.5 Special Requirements

None

10.4.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 10.4.4-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• Submit drawings of the proposed innovation or exemplary performance (if available).
Specifications	• Submit an extract of the specifications of the proposed innovation or exemplary performance (if available).
New Building in Construction Phase	
Criterion Narrative	• Updated Criterion Narrative (if different from the Design Phase).
As-Built Drawings	• Submit As-built Drawings of the proposed innovation or exemplary performance (if available).
Datasheets	• Submit the Manufacturer Datasheets / catalogs of the proposed innovation or exemplary performance (if available).
Guideline	• Provide a documentation guideline how the proposed innovation materializes.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Drawings	• Submit the As-built Drawings of the proposed innovation or exemplary performance (if available).
Datasheets	• Submit the Manufacturer Datasheets / catalogs of the proposed innovation or exemplary performance (if available).
Guideline	• Provide a documentation guideline how the proposed innovation materializes.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

10.4.4.7 Score Allocation

The score for the innovation criterion is determined based on the innovation or exemplary performance achieved. The weight factor will be set once the ARZ review committee members assess the originality and performance of the submitted innovation.

Table 10.4.4-2. Weight Factor for Each Criterion Requirement

Parameters Requirements	Weight Factor "WF"	
Innovation Feature-1	$\boldsymbol{WF_1}$	58
Innovation Feature-2	$\boldsymbol{WF_2}$	10
Innovation Feature-3	$\boldsymbol{WF_3}$	10
Innovation Feature-4	$\boldsymbol{WF_4}$	10
Innovation Feature-5	$\boldsymbol{WF_5}$	10

The calculator will determine a preliminary score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{5}(F_i * WF_i)}{\sum_{i=1}^{5} WF_i}\right]$$

Where:

- F_i is calculated using the following formula:
  If project includes innovation features, F_i=1
  If project does not include innovation features, F_i=0

11. Module: Energy

11.1 Family: Metering and Control

11.1.1En-1.1: Energy Metering

11.1.1.1 Criterion Reference and Title:

En-1.1: Energy Metering

11.1.1.2 Criterion Type:

Optional

11.1.1.3 Intent

To boost effective building-level energy metering, and to explore opportunities for additional energy savings by tracking and monitoring energy demand and consumption. To raise occupants' awareness of responsible use of energy in the building.

11.1.1.4 General Requirements

A) Energy Monitoring

For reading and maintenance purposes, install permanent energy meter(s) in an easy-to-access location where the total energy consumption of the whole building and the associated site can be measured and recorded. All multiple energy sources of each fuel type (i.e., electricity, gas, chilled water, etc.) must be considered in the readings. The energy metering data, which must be compiled into monthly and yearly summaries, must be recorded by the energy monitoring system.

B) Energy meter Type and Control

The energy meter can be either a digital meter with a data logger or a smart meter. Energy meter(s) must be connected to the Building Management System (BMS) of the building, if available.

All energy meters must be approved by the Electricity of Lebanon (EDL) and must comply with its specifications. Digital meters and smart meters must be capable of remote data access and must have data logging capability.

11.1.1.5 Special Requirements

None

11.1.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.1.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Electrical Drawings should show all the proposed energy meters, and the energy monitoring and the control system components.
Specifications	• The Specifications of all the proposed energy meters, and the energy monitoring and the control system components should be provided.
New Building in Construction Phase	
Criterion Narrative	• The updated criterion narrative (if different from the Design Phase)
As-Built Drawings	• The As-built Electrical Drawings should show all the proposed energy meters, the energy monitoring and the control system components.
Manufacturer Datasheets	• The Manufacturer Datasheets / Catalogs of all the installed energy meters, the energy monitoring and the control system components should be provided.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Drawings	• The As-built Electrical Drawings should show all the proposed energy meters, the energy monitoring and the control system components.
Manufacturer Datasheets	• The Manufacturer Datasheets / Catalogs of all the installed energy meters, the energy monitoring and the control system components should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting

documents, which can provide additional relevant information for the certification reviewers to consider.

11.1.1.7 Score Allocation

The score for this criterion is determined based on (1) the energy monitoring, (2) the energy meter type, and (3) the control requirements. Note that at least one energy meter with one energy monitoring system should be installed for the whole building in order to qualify for this criterion. Factors and weight factors are applied to each requirement as follows:

Table 11.1.1-2. Factors and Weight Factors of Each Criterion Requirement

Criterion Requirement	**Status**	**Factor "F"**		**Weight Factor "WF"**	
Energy Monitoring *	Yes	F_1	1	WF_1	5
	No		0		5
Energy Meter Control (connection to BMS)	Yes	F_2	1	WF_2	2
	No		0		2
	N/A		0		0
Energy Meter Type	Digital with data logger	F_3	1	WF_3	2
	Smart		1		3
*** Minimum prerequisite**					

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1 * \left[\frac{(F_1 * WF_1) + (F_2 * WF_2) + (F_3 * WF_3)}{(WF_1 + WF_2 + WF_3) + (3 - WF_3)}\right]$$

If the project does not include energy monitoring for the whole building, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if a smart energy meter and an energy monitoring system are installed and connected to the Building Management System (BMS).

11.1.2En-1.2: Energy Submetering

11.1.2.1 Criterion Reference and Title

En-1.2: Energy Submetering

11.1.2.2 Criterion Type

Optional

11.1.2.3 Intent

To boost additional effective energy submetering, and to explore opportunities for additional energy savings by tracking and monitoring energy demand and consumption.
To raise occupants’ awareness of responsible energy use in the building.

11.1.2.4 General Requirements

A) Energy Monitoring

Install clearly-labeled permanent energy submeters, which are easily accessible for reading and maintenance, to measure and record at a minimum 70% of the energy consumption of the following major uses (where present):

- Lighting (Internal and External)
- Power (Receptacles and High-consuming Equipment)
- HVAC (Heating, Cooling, Humidification, Ventilation)
- Refrigeration
- Domestic Hot Water.

The energy submetering data must be compiled into monthly and yearly energy use summaries and must be recorded by the energy monitoring system.

B) Energy Submeter Connection

The energy submeter can be either a digital submeter with a data logger, or a smart submeter. Energy submeter(s) can be connected to the Building Management System (BMS) of the building, if available.

11.1.2.5 Special Requirements

A) Tenant Area in All Building Sectors

The tenant area which must be independently submetered for energy consumption (electricity, gas, chilled water, etc.) must be equipped with a sufficient number of meters to that end.

The building owner/developer shall make a written commitment to implement energy submetering requirements in the tenant area as per the building sector requirements. This commitment means that future owners and tenants shall implement energy submetering as stated in their Contracts of Sale and their Rent Agreements.

B) Hotel Buildings and Residential Buildings

Lighting and receptacles for guest rooms may be metered together in case it is difficult to cost-effectively separate lighting and small power.

C) Central HVAC Systems

Submeters must be installed to measure and record chilled/hot water supply consumption to HVAC units in buildings with a central HVAC source, such as a chiller/boiler plant or a district cooling/heating system where the cooling/heating energy is delivered individually to several consumers (i.e., office, retail or tenant).

11.1.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.1.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Electrical Drawings should show all the proposed energy submeters, and the energy monitoring and the control system components.
Specifications	• The Specifications of all proposed energy submeters, and the energy monitoring and the control system components should be provided.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-Built Drawings	• The Electrical Drawings should show all the proposed energy submeters, the energy monitoring components, and the control system components.

Submittal Name	Submittal Description
Manufacturer Datasheets	• The Manufacturer Datasheets of all the installed energy submeters, and the energy monitoring and the control system components should be provided.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Drawings	• The As-built Electrical Drawings should show all the proposed energy submeters, the energy monitoring and the control system components.
Manufacturer Datasheets	• The Manufacturer Datasheets of all the installed energy submeters, the energy monitoring components, and the control system components should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.1.2.7 Score Allocation

The score for this criterion is determined based on (1) the energy monitoring, (2) the energy submeter type and (3) the control requirements. Note that at least one energy submeter with the energy monitoring system should be installed, and should record, at a minimum, 70% of the energy consumption in order to qualify for this criterion. Factors and weight factors are applied to each requirement for each building sector as follows:

OFFICE

Table 11.1.2-2. Factors and Weight Factors of Each Criterion Requirement for the Office Sector

OFFICE	Criterion Requirement		Status	Factor "F"		Weight Factor "WF"	
	Energy Monitoring	Landlord Area	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Tenant Area	Yes	F_2	1	WF_2	2
			No		0		2
			N/A		0		0
		Lighting	Yes	F_3	1	WF_3	2

		(Internal and External)	No		0		2
			N/A		0		0
		Office Equipment and Receptacles	Yes	F_4	1	WF_4	3
			No		0		3
			N/A		0		0
		High Consuming Equipment (Elevator, Data Center, Kitchen…etc.)	Yes	F_5	1	WF_5	4
			No		0		4
			N/A		0		0
		Heating	Yes	F_6	1	WF_6	4
			No		0		4
			N/A		0		0
		Cooling	Yes	F_7	1	WF_7	4
			No		0		4
			N/A		0		0
		Ventilation	Yes	F_8	1	WF_8	3
			No		0		3
			N/A		0		0
		Pumps	Yes	F_9	1	WF_9	3
			No		0		3
			N/A		0		0
		Refrigeration	Yes	F_{10}	1	WF_{10}	3
			No		0		3
			N/A		0		0
		Domestic Hot Water	Yes	F_{11}	1	WF_{11}	2
			No		0		2
			N/A		0		0
	Energy Submeter Control (connection to BMS)		Yes	F_{12}	1	WF_{12}	5
			No		0		5
			N/A		0		0
	Energy Submeter Type		Digital with data logger	F_{13}	1	WF_{13}	3
			Smart		1		5

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{13} F_i * WF_i)}{(\sum_{i=1}^{13} WF_i) + (5 - WF_{13})}\right]$$

Where

F_0 is calculated using the following formula:

If project includes at least one energy submeter ($\sum_{i=1}^{11} F_i \neq 0$) , F_0 = 1
If project does not include any energy submeters ($\sum_{i=1}^{11} F_i = 0$) , F_0 = 0

If the project does not include any energy submeters, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if smart energy submeters (1) are installed for all the aforementioned major energy uses, (2) are connected to the Building Management System (BMS), and (3) are used to record, at a minimum, 70% of the energy consumption.

MALL

Table 11.1.2-3. Factors and Weight Factors of Each Criterion Requirement for the Mall Sector

		Criterion Requirement	Status	Factor "F"		Weight Factor "WF"	
MALL	**Energy Monitoring**	Landlord Area	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Tenant Area	Yes	F_2	1	WF_2	2
			No		0		2
			N/A		0		0
		Lighting (Internal and External)	Yes	F_3	1	WF_3	3
			No		0		3
			N/A		0		0
		Office Equipment and Receptacles	Yes	F_4	1	WF_4	2
			No		0		2
			N/A		0		0
		High Consuming Equipment (Elevator, Escalator…etc.)	Yes	F_5	1	WF_5	4
			No		0		4
			N/A		0		0
		Heating	Yes	F_6	1	WF_6	5
			No		0		5
			N/A		0		0
		Cooling	Yes	F_7	1	WF_7	5
			No		0		5
			N/A		0		0
		Ventilation	Yes	F_8	1	WF_8	4
			No		0		4
			N/A		0		0
		Pumps	Yes	F_9	1	WF_9	3
			No		0		3
			N/A		0		0
		Refrigeration	Yes	F_1	1	WF_0	4

			No		0		4
			N/A		0		0
		Domestic Hot Water	Yes	F_{11}	1	WF_{11}	3
			No		0		3
			N/A		0		0
	Energy Submeter Control (connection to BMS)		Yes	F_{12}	1	WF_{12}	5
			No		0		5
			N/A		0		0
	Energy Submeter Type		Digital with data logger	F_{13}	1	WF_{13}	3
			Smart		1		5

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{13} F_i * WF_i)}{(\sum_{i=1}^{13} WF_i) + (5 - WF_{13})}\right]$$

Where

F_0 is calculated using the following formula:

If project includes at least one energy submeter $(\sum_{i=1}^{11} F_i \neq 0)$, F_0 = 1

If project does not include any energy submeters $(\sum_{i=1}^{11} F_i = 0)$, F_0 = 0

If the project does not include any energy submeters, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if smart energy submeters (1) are installed for all the aforementioned major energy uses, (2) are connected to the Building Management System (BMS), and (3) are used to record, at a minimum, 70% of the energy consumption.

HOTEL

Table 11.1.2-4. Factors and Weight Factors of Each Criterion Requirement for Hotel the Sector

	Criterion Requirement		**Status**	**Factor "F"**		**Weight Factor "WF"**	
HOTEL	**Energy Monitoring**	Landlord Area	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Tenant Area	Yes	F_2	1	WF_2	2
			No		0		2
			N/A		0		0

		Lighting (Internal and External)	Yes	F_3	1	WF_3	2
			No		0		2
			N/A		0		0
		Office Equipment and Receptacles	Yes	F_4	1	WF	3
			No		0		3
			N/A		0		0
		High Consuming Equipment (Elevator, Data Center, Kitchen, Laundry…etc.)	Yes	F_5	1	WF_5	4
			No		0		4
			N/A		0		0
		Heating	Yes	F_6	1	WF_6	5
			No		0		5
			N/A		0		0
		Cooling	Yes	F_7	1	WF_7	5
			No		0		5
			N/A		0		0
		Ventilation	Yes	F_8	1	WF_8	4
			No		0		4
			N/A		0		0
		Pumps	Yes	F_9	1	WF_9	3
			No		0		3
			N/A		0		0
		Refrigeration	Yes	F_{10}	1	WF_{10}	3
			No		0		3
			N/A		0		0
		Domestic Hot Water	Yes	F_{11}	1	WF_{11}	5
			No		0		5
			N/A		0		0
	Energy Submeter Control (connection to BMS)		Yes	F_{12}	1	WF_{12}	5
			No		0		5
			N/A		0		0
	Energy Submeter Type		Digital with data logger	F_{13}	1	WF_{13}	3
			Smart		1		5

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{13} F_i * WF_i)}{(\sum_{i=1}^{13} WF_i) + (5 - WF_{13})}\right]$$

Where

F_0 is calculated using the following formula:
If project includes at least one energy submeter ($\sum_{i=1}^{11} F_i \neq 0)$, F_0 = 1
If project does not include any energy submeters ($\sum_{i=1}^{11} F_i = 0)$, F_0 = 0

If the project does not include any energy submeters, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if smart energy submeters (1) are installed for all the aforementioned major energy uses, (2) are connected to the Building Management System (BMS), and (3) are used to record, at a minimum, 70% of the energy consumption.

EDUCATIONAL FACILITIES

Table 11.1.2-5. Factors and Weight Factors of Each Criterion Requirement for the Educational Sector

	Criterion Requirement		**Status**	**Factor “F”**		**Weight Factor “WF”**	
EDUCATIONAL FACILITIES	**Energy Monitoring**	Landlord Area	Yes	$\boldsymbol{F_1}$	1	$\boldsymbol{WF_1}$	2
			No		0		2
			N/A		0		0
		Tenant Area	Yes	$\boldsymbol{F_2}$	1	$\boldsymbol{WF_2}$	2
			No		0		2
			N/A		0		0
		Lighting (Internal and External)	Yes	$\boldsymbol{F_3}$	1	$\boldsymbol{WF_3}$	2
			No		0		2
			N/A		0		0
		Office Equipment and Receptacles	Yes	$\boldsymbol{F_4}$	1	$\boldsymbol{WF_4}$	3
			No		0		3
			N/A		0		0
		High Consuming Equipment (Elevator, Data Center, Kitchen…etc.)	Yes	$\boldsymbol{F_5}$	1	$\boldsymbol{WF_5}$	3
			No		0		3
			N/A		0		0
		Heating	Yes	$\boldsymbol{F_6}$	1	$\boldsymbol{WF_6}$	5
			No		0		5
			N/A		0		0
		Cooling	Yes	$\boldsymbol{F_7}$	1	$\boldsymbol{WF_7}$	5
			No		0		5
			N/A		0		0
		Ventilation	Yes	$\boldsymbol{F_8}$	1	$\boldsymbol{WF_8}$	4
			No		0		4
			N/A		0		0
		Pumps	Yes	$\boldsymbol{F_9}$	1	$\boldsymbol{WF_9}$	3
			No		0		3
			N/A		0		0

		Refrigeration	Yes	F_{10}	1	WF_{10}	2
			No		0		2
			N/A		0		0
		Domestic Hot Water	Yes	F_{11}	1	WF_{11}	2
			No		0		2
			N/A		0		0
	Energy Submeter Control (connection to BMS)		Yes	F_{12}	1	WF_{12}	5
			No		0		5
			N/A		0		0
	Energy Submeter Type		Digital with data logger	F_{13}	1	WF_{13}	3
			Smart		1		5

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{13} F_i * WF_i)}{(\sum_{i=1}^{13} WF_i) + (5 - WF_{13})}\right]$$

Where

F_0 is calculated using the following formula:

If project includes at least one energy submeter $(\sum_{i=1}^{11} F_i \neq 0)$, F_0 = 1

If project does not include any energy submeters $(\sum_{i=1}^{11} F_i = 0)$, F_0 = 0

If the project does not include any energy submeters, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if smart energy submeters (1) are installed for all the aforementioned major energy uses, (2) are connected to the Building Management System (BMS), and (3) are used to record, at a minimum, 70% of the energy consumption.

HOSPITAL

Table 11.1.2-6. Factors and Weight Factors of Each Criterion Requirement for the Hospital Sector

HOSPITAL	**Criterion Requirement**		**Status**	**Factor “F”**		**Weight Factor “WF”**	
	Energy Monitoring	Landlord Area	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Tenant Area	Yes	F_2	1	WF_2	2
			No		0		2
			N/A		0		0

		Lighting (Internal and External)	Yes	F_3	1	WF_3	2
			No		0		2
			N/A		0		0
		Medical Equipment and Receptacles	Yes	F_4	1	WF	4
			No		0		4
			N/A		0		0
		High Consuming Equipment (Elevator, Data Center, Kitchen, Laundry…etc.)	Yes	F_5	1	WF_5	4
			No		0		4
			N/A		0		0
		Heating	Yes	F_6	1	WF_6	5
			No		0		5
			N/A		0		0
		Cooling	Yes	F_7	1	WF_7	5
			No		0		5
			N/A		0		0
		Ventilation	Yes	F_8	1	WF_8	4
			No		0		4
			N/A		0		0
		Pumps	Yes	F_9	1	WF_9	3
			No		0		3
			N/A		0		0
		Refrigeration	Yes	F_{10}	1	WF_{10}	4
			No		0		4
			N/A		0		0
		Domestic Hot Water	Yes	F_{11}	1	WF_{11}	5
			No		0		5
			N/A		0		0
	Energy Submeter Control (connection to BMS)		Yes	F_{12}	1	WF_{12}	5
			No		0		5
			N/A		0		0
	Energy Submeter Type		Digital with data logger	F_{13}	1	WF_{13}	3
			Smart		1		5

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{13} F_i * WF_i)}{(\sum_{i=1}^{13} WF_i) + (5 - WF_{13})}\right]$$

Where

F_0 is calculated using the following formula:
If project includes at least one energy submeter ($\sum_{i=1}^{11} F_i \neq 0$) , F_0 = 1
If project does not include any energy submeters ($\sum_{i=1}^{11} F_i = 0$) , F_0 = 0

If the project does not include any energy submeters, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if smart energy submeters (1) are installed for all the aforementioned major energy uses, (2) are connected to the Building Management System (BMS), and (3) are used to record, at a minimum, 70% of the energy consumption.

RESIDENTIAL

Table 11.1.2-7. Factors and Weight Factors of Each Criterion Requirement for the Residential Sector

	Criterion Requirement		Status	Factor “F”		Weight Factor “WF”	
RESIDENTIAL	**Energy Monitoring**	Landlord Area	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		Tenant Area	Yes	F_2	1	WF_2	2
			No		0		2
			N/A		0		0
		Lighting (Internal and External)	Yes	F_3	1	WF_3	2
			No		0		2
			N/A		0		0
		Small Equipment and Receptacles	Yes	F_4	1	WF_4	2
			No		0		2
			N/A		0		0
		High Consuming Equipment (Elevator, Kitchen, Laundry…etc.)	Yes	F_5	1	WF_5	4
			No		0		4
			N/A		0		0
		Heating	Yes	F_6	1	WF_6	5
			No		0		5
			N/A		0		0
		Cooling	Yes	F_7	1	WF_7	5
			No		0		5
			N/A		0		0
		Ventilation	Yes	F_8	1	WF_8	3
			No		0		3
			N/A		0		0
		Pumps	Yes	F_9	1	WF_9	3
			No		0		3

			N/A		0		0
		Refrigeration	Yes	F_{10}	1	WF_{10}	4
			No		0		4
			N/A		0		0
		Domestic Hot Water	Yes	F_{11}	1	WF_{11}	5
			No		0		5
			N/A		0		0
	Energy Submeter Control (connection to BMS)		Yes	F_{12}	1	WF_{12}	5
			No		0		5
			N/A		0		0
	Energy Submeter Type		Digital with data logger	F_{13}	1	WF_{13}	3
			Smart		1		5

The calculator will determine the exact score for complying with the requirements as per the weighted average. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_0 * \left[\frac{(\sum_{i=1}^{13} F_i * WF_i)}{(\sum_{i=1}^{13} WF_i) + (5 - WF_{13})}\right]$$

Where

F_0 is calculated using the following formula:

If project includes at least one energy submeter ($\sum_{i=1}^{11} F_i \neq 0$) , F_0 = 1

If project does not include any energy submeters ($\sum_{i=1}^{11} F_i = 0$) , F_0 = 0

If the project does not include any energy submeters, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if smart energy submeters (1) are installed for all the aforementioned major energy uses, (2) are connected to the Building Management System (BMS), and (3) are used to record, at a minimum, 70% of the energy consumption.

11.1.3En-1.3: Building Automation System/Building Management System

11.1.3.1 Criterion Reference and Title

En-1.3: Building Automation System (BAS)/Building Management System (BMS)

11.1.3.2 Criterion Type

Optional

11.1.3.3 Intent

To boost effective additional building energy management, to explore opportunities for additional energy saving, and to ensure a safe, secure, comfortable and energy efficient environment by controlling and monitoring the building's mechanical and electrical services.

11.1.3.4 General Requirements

A computer-based control system installed in buildings, known as a Building Management System (BMS) or as a Building Automation System (BAS), controls and monitors the building's mechanical and electrical equipment such as lighting, power systems, fire systems, security systems, and HVAC systems. The major aim of the BMS is to guarantee the safety of the Facility operations while monitoring and optimizing the use and efficiency of its supervised subsystems to allow for more efficiency in operations.

A Building Management System (BMS) must integrate, at a minimum, hardware, software and a communication system. A BMS collects data, monitors functions, predicts operations, and prescribes automated responses to achieve optimum performance.

A BMS must comprise

- Components which connect mechanical systems, electrical systems, power, communications, and lighting using sensors, monitors, actuators, controllers, communication technology, etc.
- Systems which optimize comfort, energy performance, safety, and security
- Interfaces for configuration, initialization, system maintenance, fault detection, diagnostics, predictive maintenance, and continuous improvement.

The proposed BMS system and its components shall be compatible with a wide variety of control devices using BACnet, LON, Ethernet TCP/IP, ModBus and OPC standard for open system communications, and other current international communication standards. A BMS point schedule must be submitted and shall include, but not be limited to, the following as applicable:

Table 11.1.3-1. BMS Point Schedule

HVAC	
Fan Coil Units (FCUs)	* Space temperature monitoring * FCU fan run status * HVAC status (Heating, Cooling, Humidification, Ventilation) * Room temperature set point * A three-speed switch
Package Units (PUs)	* Space temperature monitoring * PU fan run status * HVAC status (Heating, Cooling, Humidification, Ventilation) * Auto-manual switch * Trip status
Air Handling Units (Re-circulating Type) (AHUs)	* Manual Hand-of-Auto (HOA) switch at AHU * Indoor space air temperature and humidity monitoring * Outdoor ambient air temperature and humidity monitoring * Enthalpy sensor for outdoor air * Mixing air temperature and humidity between outdoor air and return air * AHU fans run status * AHU fans Start/Stop command * Cooling coil air On/Off temperature monitoring * Reheat coil On /Off monitoring * Filter status * Reheat coil trip alarm * VSD enable/disable * VSD speed control * VSD speed feedback * Variable speed drive fault * Variable speed drive run status
Fresh Air Handling Units (FAHUs)	* Variable speed drive fault * VSD speed feedback * VSD speed control * VSD enable/disable * Supply duct pressure

	* Fire Alarm * Ambient temperature and humidity * Exhaust Air (EA) temperature * Chilled water control valve modulate * Supply air temperature * Off coil temperature * Filter status * Thermal wheel trip status * Wheel run status * Thermal wheel Start/Stop * Hand-of-auto (HOA) switch auto status (Thermal wheel) * Fan Start/Stop command * Fan trip status (supply & return) * Fan run status (supply & extract) * Hand-of-Auto (HOA) switch auto status (supply & extract) * Variable speed drive run status * Humidity duct (supply/intake) * Air flow indicator
Close Control Unit (CCU)	* Unit Start/Stop command * Fan run status * Cooling coil air On/Off temperature * Reheat coil air On/Off temperature * Filter status * Humidifier On/Off status * Space temperature * Space humidity * Temperature set point * Humidity set point * Select or switch position
VAV/CAV – Terminal Units	* Room temperature and set point * Airflow * Damper position * Heater On/Off command (if applicable)
Extract Fans	* Fan start/stop * Fan status from MCC panel

	* Trip alarm indication * VSD enable/disable * VSD speed control * VSD speed feedback * Variable speed drive fault and run status
Control/Fire Damper	* Damper Open/Close status
CO_2 Control Panel	* Run status * System alarm * Trip alarm indication
Chilled Water Pumps	* Pump run status * Pump Start/Stop command * Indication of manual switch position * Pump trip alarm indication * Pump speed for variable speed units * Pump discharge pressure at common header * Supply and return water pressure
Chilled water Pressurization Units	* Chilled water system pressure * Panel power supply status * Running switch indicator * High/Low pressure alarm
Cooling Towers	* System enable * Outside air temperature * Outside air humidity * Condenser water bypass valve * Fan status * Fan speed * Common alarm * Condenser water discharge temperature and setpoint * Condenser water return temperature * Makeup water flow - totalized * Vibration alarm * High basin level * Low basin level
WATER	

Water Pump Sets (Booster + Filtration)	* Hand-of-Auto (HOA) switch position indicating * Pump Start/Stop command * Run status of each pump * Pump trip alarm indication * System pressure * Running switch indicator
Water Tanks	* Level indication * High/Low level alarm * Fire water reserve
Water filtration system	* Water differential pressure * Backwash cycle on status * Backwash cycle off status * Common system fault /alarm signal
Irrigation pumps	* Pump Start/Stop command * Pump run status * Pump trip signal * System pressure
Water Monitoring Meters	* Monitor and record (hourly, daily, weekly and annually). * Compare consumption for the recorded periods for trend analysis. * Determine 'out-of-range' values and alert building operator. * Record peak energy consumption for each end use.
FIRE	
Fire Pump Set	* System Pressure * Run status of each pump * Diesel pump battery start-up * Trip alarm indication of electric pump and fail to start indication from diesel pump
Fire Alarm System	* All system alarms * Common fault alarm * Power On/Off status
ELECTRICAL	
Occupancy and Daylight Detection System	* All occupancy and daylight sensors' status in all areas * HVAC system control based on the occupancy sensors' status received from the lighting control system * Thermostats in all rooms controlled and reset based on occupancy * Motorized curtains controlled based on the daylight sensors'

	status
Electricity Monitoring Meters	* Monitor and record electricity (hourly, daily, weekly, and annually). * Compare consumption during the recorded periods for trend analysis. * Determine 'out-of-range' values and alert building operator. * Record peak energy consumption for each end use.
Lift	* Lift status * Lift stuck-up status * Fireman override switch
Escalator	* Escalator status * Escalator stuck-up status
UPS	* On/Off status * UPS fault alarm * UPS low battery conditions
Public Address/ Access Control/ CCTV System	* All system alarms * Common fault alarm * Power On/Off status
EMERGENCY GENERATOR	
Generator	* Status * Mode (Off, Auto, Run) * Common alarm
Automatic Transfer Switch	* Status
Fuel Oil System	* High main tank level * Low main tank level * High day tank level * Low day tank level * Main tank room leak * Piping leak * Day tank leak * Pump set on auto - manual switch flow status * Pump set leak * Common alarm

11.1.3.5 Special Requirements

None

11.1.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.1.3-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
BMS drawings	- The BMS drawings and the riser diagrams for the proposed BMS system should be provided. They should illustrate the proposed management strategy and confirm that the required level of management will be achieved.
BMS point schedule	- BMS point schedule on the ARZ portal
Specifications	- The Specifications of the proposed BMS system should be provided.
New Building in Construction Phase	
Criterion Narrative	- The updated Criterion Narrative (if different from the Design Phase).
Manufacturer Datasheets	- The Manufacturer Technical Datasheets for the installed BMS system should be provided.
As-built BMS drawings	- The As-built BMS drawings and the riser diagrams of the proposed BMS system should be provided. They should illustrate the proposed management strategy and confirm that the required level of management is achieved.
- BMS point schedule	- BMS point schedule on the ARZ portal
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturer Datasheets	- The Manufacturer Technical Datasheets of the installed BMS system should be provided
As-built BMS drawings	- The As-built BMS Drawings and the riser diagrams of the proposed BMS should be provided. They should illustrate the proposed management strategy and confirm that the required level of management will be achieved.
- BMS point schedule	- BMS point schedule on the ARZ portal

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.1.3.7 Score Allocation

The score for this criterion is determined based on the BMS point schedule requirements. Note that at least one BMS point for any system should be applied for the BMS system in order to qualify for this criterion. Factors and weight factors are applied to each requirement as follows:

Table 11.1.3-3. Factors and Weight Factors of Each Criterion Requirement

Criterion requirement		**Status**	**Factor "F"**		**Weight Factor "WF"**	
HVAC SYSTEM						
Fan Coil Units	Monitoring of space temperature	Yes	F_1	1	WF_1	1
		No		0		1
		N/A		0		0
	FCU fan run status	Yes	F_2	1	WF_2	1
		No		0		1
		N/A		0		0
	HVAC status	Yes	F_3	1	WF_3	1
		No		0		1
		N/A		0		0
	Room temperature set point	Yes	F_4	1	WF_4	1
		No		0		1
		N/A		0		0
	Three-speed switches	Yes	F_5	1	WF_5	1
		No		0		1
		N/A		0		0
Package Units	Space temperature monitoring	Yes	F_6	1	WF_6	1
		No		0		1
		N/A		0		0
	PU fan run status	Yes	F_7	1	WF_7	1
		No		0		1

		N/A		0		0
	HVAC status	Yes	F_8	1	WF_8	1
		No		0		1
		N/A		0		0
	Auto-manual switch	Yes	F_9	1	WF_9	1
		No		0		1
		N/A		0		0
	Trip Status	Yes	F_{10}	1	WF_{10}	1
		No		0		1
		N/A		0		0
Air Handling Units (Re-circulating)	Indication of manual Hand-of-Auto (HOA) switch at AHU	Yes	F_{11}	1	F_{11}	1
		No		0		1
		N/A		0		0
	Indoor space air temperature and humidity monitoring	Yes	F_{12}	1	WF_{12}	1
		No		0		1
		N/A		0		0
	Outdoor ambient air temperature and humidity monitoring	Yes	F_{13}	1	WF_{13}	1
		No		0		1
		N/A		0		0
	Enthalpy Sensor for outdoor air	Yes	F_{14}	1	WF_{14}	1
		No		0		1
		N/A		0		0
	Mixing air temperature and humidity between outdoor air and return air	Yes	F_{15}	1	WF_{15}	1
		No		0		1
		N/A		0		0
	AHU fans run status	Yes	F_{16}	1	WF_{16}	1
		No		0		1
		N/A		0		0
	AHU fans Start/Stop command	Yes	F_{17}	1	WF_{17}	1
		No		0		1
		N/A		0		0
	Cooling coil air on / air off temperatures monitoring	Yes	F_{18}	1	WF_{18}	1
		No		0		1
		N/A		0		0

	Reheat coil On/Off monitoring	Yes	F_{19}	1	WF_{19}	1
		No		0		1
		N/A		0		0
	Filter status	Yes	F_{20}	1	WF_{20}	1
		No		0		1
		N/A		0		0
	Reheat coil trip alarm	Yes	F_{21}	1	WF_{21}	1
		No		0		1
		N/A		0		0
	VSD enable/disable	Yes	F_{22}	1	WF_{22}	3
		No		0		3
		N/A		0		0
	VSD speed control	Yes	F_{23}	1	WF_{23}	3
		No		0		3
		N/A		0		0
	VSD speed feedback	Yes	F_{24}	1	WF_{24}	3
		No		0		3
		N/A		0		0
	Variable speed drive fault	Yes	F_{25}	1	WF_{25}	3
		No		0		3
		N/A		0		0
	Variable speed drive run status	Yes	F_{26}	1	WF_{26}	3
		No		0		3
		N/A		0		0
Fresh Air Handling Units	Variable speed drive fault	Yes	F_{27}	1	WF_{27}	3
		No		0		3
		N/A		0		0
	VSD speed feedback	Yes	F_{28}	1	WF_{28}	3
		No		0		3
		N/A		0		0
	VSD speed control	Yes	F_{29}	1	WF_{29}	3
		No		0		3
		N/A		0		0
	VSD enable/disable	Yes	F_{30}	1	WF_{30}	3
		No		0		3

		N/A		0		0
	Supply duct pressure	Yes	F_{31}	1	WF_{31}	1
		No		0		1
		N/A		0		0
	Fire alarm	Yes	F_{32}	1	WF_{32}	1
		No		0		1
		N/A		0		0
	Ambient temperature and humidity	Yes	F_{33}	1	WF_{33}	1
		No		0		1
		N/A		0		0
	Exhaust Air (EA) temperature	Yes	F_{34}	1	WF_{34}	1
		No		0		1
		N/A		0		0
	Chilled water control valve modulate	Yes	F_{35}	1	WF_{35}	1
		No		0		1
		N/A		0		0
	Supply air temperature	Yes	F_{36}	1	WF_{36}	1
		No		0		1
		N/A		0		0
	Off coil temperature	Yes	F_{37}	1	WF_{37}	1
		No		0		1
		N/A		0		0
	Filter status	Yes	F_{38}	1	WF_{38}	1
		No		0		1
		N/A		0		0
	Thermal wheel trip status	Yes	F_{39}	1	WF_{39}	1
		No		0		1
		N/A		0		0
	Wheel run status	Yes	F_{40}	1	WF_{40}	1
		No		0		1
		N/A		0		0
	Thermal wheel Start/Stop	Yes	F_{41}	1	WF_{41}	1
		No		0		1
		N/A		0		0

	Hand-of-Auto (HOA) switch auto status (Thermal wheel)	Yes	F_{42}	1	WF_{42}	1
		No		0		1
		N/A		0		0
	Damper actuator motorized - Outside air	Yes	F_{43}	1	WF_{43}	1
		No		0		1
		N/A		0		0
	Fan trip status (Supply & Return)	Yes	F_{44}	1	WF_{44}	1
		No		0		1
		N/A		0		0
	Fan run status (Supply & Extract)	Yes	F_{45}	1	WF_{45}	1
		No		0		1
		N/A		0		0
	Fan Start/Stop command	Yes	F_{46}	1	WF_{46}	1
		No		0		1
		N/A		0		0
	Hand-of-Auto (HOA) switch auto status (Supply & Extract)	Yes	F_{47}	1	WF_{47}	1
		No		0		1
		N/A		0		0
	Variable speed drive run status	Yes	F_{48}	1	WF_{48}	3
		No		0		3
		N/A		0		0
	Humidity duct (Supply/Intake)	Yes	F_{49}	1	WF_{49}	1
		No		0		1
		N/A		0		0
	Air flow indicator	Yes	F_{50}	1	WF_{50}	1
		No		0		1
		N/A		0		0
Close Control Unit	Unit Start/Stop	Yes	F_{51}	1	WF_{51}	1
		No		0		1
		N/A		0		0
	Fan run status	Yes	F_{52}	1	WF_{52}	1
		No		0		1
		N/A		0		0
		Yes	F_{53}	1	WF_{53}	1

	Cooling coil air On/Off temperature	No		0		1
		N/A		0		0
	Reheat coil air On/Off temperature	Yes	F_{54}	1	WF_{54}	1
		No		0		1
		N/A		0		0
	Filter status	Yes	F_{55}	1	WF_{55}	1
		No		0		1
		N/A		0		0
	Humidifier On/Off status	Yes	F_{56}	1	WF_{56}	1
		No		0		1
		N/A		0		0
	Space temperature	Yes	F_{57}	1	WF_{57}	1
		No		0		1
		N/A		0		0
	Space humidity	Yes	F_{58}	1	WF_{58}	1
		No		0		1
		N/A		0		0
	Temperature set point	Yes	F_{59}	1	WF_{59}	1
		No		0		1
		N/A		0		0
	Humidity set point	Yes	F_{60}	1	WF_{60}	1
		No		0		1
		N/A		0		0
	Selector switch position	Yes	F_{61}	1	WF_{61}	1
		No		0		1
		N/A		0		0
VAV/CAV – Terminal Units	Room temperature and set point	Yes	F_{62}	1	WF_{62}	1
		No		0		1
		N/A		0		0
	Airflow	Yes	F_{63}	1	WF_{63}	1
		No		0		1
		N/A		0		0
	Damper position	Yes	F_{64}	1	WF_{64}	1
		No		0		1

		N/A		0		0
	Heater On/Off (if applicable)	Yes	F_{65}	1	WF_{65}	1
		No		0		1
		N/A		0		0
Extract Fans	Fans Start/Stop	Yes	F_{66}	1	WF_{66}	1
		No		0		1
		N/A		0		0
	Fan status from MCC panel	Yes	F_{67}	1	WF_{67}	1
		No		0		1
		N/A		0		0
	Trip alarm indication	Yes	F_{68}	1	WF_{68}	1
		No		0		1
		N/A		0		0
	VSD enable/disable	Yes	F_{69}	1	WF_{69}	3
		No		0		3
		N/A		0		0
	VSD speed control	Yes	F_{70}	1	WF_{70}	3
		No		0		3
		N/A		0		0
	VSD speed feedback	Yes	F_{71}	1	WF_{71}	3
		No		0		3
		N/A		0		0
	Variable speed drive fault and run status	Yes	F_{72}	1	WF_{72}	3
		No		0		3
		N/A		0		0
Control/Fire Damper	Damper Open/Close status	Yes	F_{73}	1	WF_{73}	1
		No		0		1
		N/A		0		0
CO_2 Control Panel	Run status	Yes	F_{74}	1	WF_{74}	1
		No		0		1
		N/A		0		0
	System alarm	Yes	F_{75}	1	WF_{75}	1
		No		0		1
		N/A		0		0

	Trip alarm indication	Yes	F_{76}	1	WF_{76}	1
		No		0		1
		N/A		0		0
Chilled Water Pumps	Pump run status	Yes	F_{77}	1	WF_{77}	1
		No		0		1
		N/A		0		0
	Pumps Start/Stop	Yes	F_{78}	1	WF_{78}	1
		No		0		1
		N/A		0		0
	Manual switch position indication	Yes	F_{79}	1	WF_{79}	1
		No		0		1
		N/A		0		0
	Pump trip alarm indication	Yes	F_{80}	1	WF_{80}	1
		No		0		1
		N/A		0		0
	Pump speed for variable speed units	Yes	F_{81}	1	WF_{81}	3
		No		0		3
		N/A		0		0
	Pump discharge pressure at common header	Yes	F_{82}	1	WF_{82}	1
		No		0		1
		N/A		0		0
	Supply and return water pressure	Yes	F_{83}	1	WF_{83}	1
		No		0		1
		N/A		0		0
CHW Pressurization Units	Chilled water system pressure	Yes	F_{84}	1	WF_{84}	1
		No		0		1
		N/A		0		0
	Panel power supply status	Yes	F_{85}	1	WF_{85}	1
		No		0		1
		N/A		0		0
	Running switch indicator	Yes	F_{86}	1	WF_{86}	1
		No		0		1
		N/A		0		0
	High/Low pressure alarm	Yes	F_{87}	1	WF_{87}	1

		No		0		1
		N/A		0		0
Cooling Towers	System status	Yes	F_{88}	1	WF_{88}	1
		No		0		1
		N/A		0		0
	Outside air temperature	Yes	F_{89}	1	WF_{89}	1
		No		0		1
		N/A		0		0
	Outside air humidity	Yes	F_{90}	1	WF_{90}	1
		No		0		1
		N/A		0		0
	Condenser water bypass valve	Yes	F_{91}	1	WF_{91}	1
		No		0		1
		N/A		0		0
	Fan status	Yes	F_{92}	1	WF_{92}	1
		No		0		1
		N/A		0		0
	Fan speed	Yes	F_{93}	1	WF_{93}	1
		No		0		1
		N/A		0		0
	Common alarm	Yes	F_{94}	1	WF_{94}	1
		No		0		1
		N/A		0		0
	Condenser water discharge temperature and set point	Yes	F_{95}	1	WF_{95}	1
		No		0		1
		N/A		0		0
	Condenser water return temperature	Yes	F_{96}	1	WF_{96}	1
		No		0		1
		N/A		0		0
	Makeup water flow - totalized	Yes	F_{97}	1	WF_{97}	1
		No		0		1
		N/A		0		0
	Vibration alarm	Yes	F_{98}	1	WF_{98}	1
		No		0		1

		N/A		0		0
	High basin level	Yes	F_{99}	1	WF_{99}	1
		No		0		1
		N/A		0		0
	Low basin level	Yes	F_{100}	1	WF_{100}	1
		No		0		1
		N/A		0		0
WATER						
Water Pump Sets (Booster + Filtration)	Hand-of-Auto (HOA) switch position indicating	Yes	F_{101}	1	WF_{101}	1
		No		0		1
		N/A		0		0
	Pump Start/Stop	Yes	F_{102}	1	WF_{102}	1
		No		0		1
		N/A		0		0
	Run status of each pump	Yes	F_{103}	1	WF_{103}	1
		No		0		1
		N/A		0		0
	Pump trip alarm indication	Yes	F_{104}	1	WF_{104}	1
		No		0		1
		N/A		0		0
	System Pressure	Yes	F_{105}	1	WF_{105}	1
		No		0		1
		N/A		0		0
	Running switch indicator	Yes	F_{106}	1	WF_{106}	1
		No		0		1
		N/A		0		0
Water Tanks	Level indication	Yes	F_{107}	1	WF_{107}	1
		No		0		1
		N/A		0		0
	High/Low level alarm	Yes	F_{108}	1	WF_{108}	1
		No		0		1
		N/A		0		0
	Fire water reserve	Yes	F_{109}	1	WF_{109}	1
		No		0		1

		N/A		0		0
Water filtration system	Water differential pressure	Yes	F_{110}	1	WF_{110}	1
		No		0		1
		N/A		0		0
	Backwash cycle on status	Yes	F_{111}	1	WF_{111}	1
		No		0		1
		N/A		0		0
	Backwash cycle off status	Yes	F_{112}	1	WF_{112}	1
		No		0		1
		N/A		0		0
	Common system fault /alarm signal	Yes	F_{113}	1	WF_{113}	1
		No		0		1
		N/A		0		0
Irrigation pumps	Pump Start/Stop command	Yes	F_{114}	1	WF_{114}	1
		No		0		1
		N/A		0		0
	Pump run status	Yes	F_{115}	1	WF_{115}	1
		No		0		1
		N/A		0		0
	Pump trip signal	Yes	F_{116}	1	WF_{116}	1
		No		0		1
		N/A		0		0
	System pressure	Yes	F_{117}	1	WF_{117}	1
		No		0		1
		N/A		0		0
Water Monitoring Meters	Monitor and record (hourly, daily, weekly and annually)	Yes	F_{118}	1	WF_{118}	1
		No		0		1
		N/A		0		0
	Compare consumption during the recorded periods for trend analysis.	Yes	F_{119}	1	WF_{119}	1
		No		0		1
		N/A		0		0
	Determine ‘out-of-range’ values and alert building operator	Yes	F_{120}	1	WF_{120}	1
		No		0		1
		N/A		0		0

	Record peak energy consumption for each end use	Yes	F_{121}	1	WF_{121}	1
		No		0		1
		N/A		0		0
FIRE						
Fire Pump Set	System Pressure	Yes	F_{122}	1	WF_{122}	1
		No		0		1
		N/A		0		0
	Run status of each pump	Yes	F_{123}	1	WF_{123}	1
		No		0		1
		N/A		0		0
	Diesel pump battery start-up	Yes	F_{124}	1	WF_{124}	1
		No		0		1
		N/A		0		0
	Trip alarm indication of electric pump and fail to start indication from diesel pump	Yes	F_{125}	1	WF_{125}	1
		No		0		1
		N/A		0		0
Fire Alarm System	All system alarms	Yes	F_{126}	1	WF_{126}	1
		No		0		1
		N/A		0		0
	Common fault alarm	Yes	F_{127}	1	WF_{127}	1
		No		0		1
		N/A		0		0
	Power On/Off status	Yes	F_{128}	1	WF_{128}	1
		No		0		1
		N/A		0		0
ELECTRICAL						
Occupancy and Daylight Detection System	Status of all occupancy and daylight sensors in all areas	Yes	F_{129}	1	WF_{129}	1
		No		0		1
		N/A		0		0
	HVAC system control based on the occupancy sensors status received from lighting control system	Yes	F_{130}	1	WF_{130}	1
		No		0		1
		N/A		0		0

	Control and reset all rooms' thermostats based on occupancy	Yes	F_{131}	1	WF_{131}	1
		No		0		1
		N/A		0		0
	Control motorized curtains based on daylight sensors' status	Yes	F_{132}	1	WF_{132}	1
		No		0		1
		N/A		0		0
Electricity Monitoring Meters	Monitor and record (hourly, daily, weekly and annually)	Yes	F_{133}	1	WF_{133}	1
		No		0		1
		N/A		0		0
	Compare consumption during the recorded periods for trend analysis	Yes	F_{134}	1	WF_{134}	1
		No		0		1
		N/A		0		0
	Determine 'out-of-range' values and alert building operator	Yes	F_{135}	1	WF_{135}	1
		No		0		1
		N/A		0		0
	Record peak energy consumption for each end use	Yes	F_{136}	1	WF_{136}	1
		No		0		1
		N/A		0		0
Lift	Lift status	Yes	F_{137}	1	WF_{137}	1
		No		0		1
		N/A		0		0
	Lift stuck-up status	Yes	F_{138}	1	WF_{138}	1
		No		0		1
		N/A		0		0
	Fireman override switch	Yes	F_{139}	1	WF_{139}	1
		No		0		1
		N/A		0		0
Escalator	Escalator status	Yes	F_{140}	1	WF_{140}	1
		No		0		1
		N/A		0		0
	Escalator stuck-up status	Yes	F_{141}	1	WF_{141}	1
		No		0		1
		N/A		0		0
UPS	UPS On/Off status	Yes	F_{142}	1	WF_{142}	1

		No		0		1
		N/A		0		0
	UPS fault alarm	Yes	F_{143}	1	WF_{143}	1
		No		0		1
		N/A		0		0
	UPS low battery conditions	Yes	F_{144}	1	WF_{144}	1
		No		0		1
		N/A		0		0
Public Address/ Access Control/ CCTV System	All system alarms	Yes	F_{145}	1	WF_{145}	1
		No		0		1
		N/A		0		0
	Common fault alarm	Yes	F_{146}	1	WF_{146}	1
		No		0		1
		N/A		0		0
	Power On/Off status	Yes	F_{147}	1	WF_{147}	1
		No		0		1
		N/A		0		0
EMERGENCY GENERATOR						
Generator	Status	Yes	F_{148}	1	WF_{148}	1
		No		0		1
		N/A		0		0
	Mode (Off, Auto, Run)	Yes	F_{149}	1	WF_{149}	1
		No		0		1
		N/A		0		0
	Common alarm	Yes	F_{150}	1	WF_{150}	1
		No		0		1
		N/A		0		0
Automatic Transfer Switch	Status	Yes	F_{151}	1	WF_{151}	1
		No		0		1
		N/A		0		0
Fuel Oil System	High main tank level	Yes	F_{152}	1	WF_{152}	1
		No		0		1
		N/A		0		0
	Low main tank level	Yes	F_{153}	1	WF_{153}	1

		No		0		1
		N/A		0		0
	High day tank level	Yes	$\boldsymbol{F_{154}}$	1	$\boldsymbol{WF_{154}}$	1
		No		0		1
		N/A		0		0
	Low day tank level	Yes	$\boldsymbol{F_{155}}$	1	$\boldsymbol{WF_{155}}$	1
		No		0		1
		N/A		0		0
	Main tank room leak	Yes	$\boldsymbol{F_{156}}$	1	$\boldsymbol{WF_{156}}$	1
		No		0		1
		N/A		0		0
	Piping Leak	Yes	$\boldsymbol{F_{157}}$	1	$\boldsymbol{WF_{157}}$	1
		No		0		1
		N/A		0		0
	Day tank leak	Yes	$\boldsymbol{F_{158}}$	1	$\boldsymbol{WF_{158}}$	1
		No		0		1
		N/A		0		0
	Pump set auto - manual switch flow status	Yes	$\boldsymbol{F_{159}}$	1	$\boldsymbol{WF_{159}}$	1
		No		0		1
		N/A		0		0
	Pump set leak	Yes	$\boldsymbol{F_{160}}$	1	$\boldsymbol{WF_{160}}$	1
		No		0		1
		N/A		0		0
	Common alarm	Yes	$\boldsymbol{F_{161}}$	1	$\boldsymbol{WF_{161}}$	1
		No		0		1
		N/A		0		0

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{161} F_i * WF_i)}{(\sum_{i=1}^{161} WF_i)}\right]$$

If any system is connected to the BMS, the score for this criterion will be 0%. A project can earn a score of 100% for this criterion if all the aforementioned possible systems are connected to the BMS system.

11.2 Family: Building Envelope

11.2.1En-2.1: Opaque Thermal Transmittance

11.2.1.1 Criterion Reference and Title

En-2.1: Opaque Thermal Transmittance

11.2.1.2 Criterion Type

Optional

11.2.1.3 Intent

To support a proper building envelope design for the Opaque Thermal Transmittance, and to select specific materials with proper thermal and physical parameters as per the specific climate zone which reduces the energy consumption of the building.

11.2.1.4 General Requirements

As per the Thermal Standard for Buildings in Lebanon 2005, Lebanon is divided into four climatic zones based on temperature, relative humidity and solar radiation as follows:

Zone 1 – Coastal
Zone 2 – Western Mid- Mountain
Zone 3 – Inland Plateau
Zone 4 – High Mountain

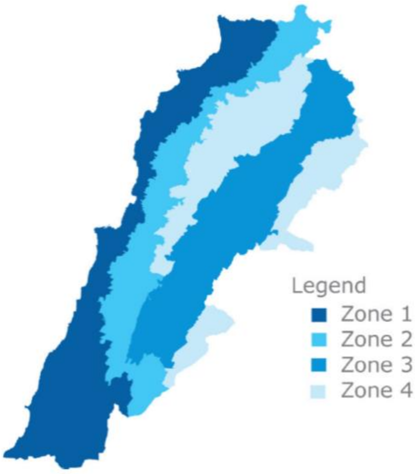


Figure 11.2.1-1. Lebanon's climate zones

The approximate altitude and degree-day limits threshold for each zone are presented in the following table:

Table 11.2.1-1. Lebanon's Climate Zones

Climatic Zone	Approximate Altitude range	Approximate HDD (18) and CDD (21) Thresholds
Zone 1 **Coastal**	0-700 m	300 < HDD < 1200 120 < CDD < 1050
Zone 2 **Western Mid-Mountain**	700-1400 m	1200 < HDD < 2000 0 < CDD < 120
Zone 3	700-1150 m	1200 < HDD < 1800

Inland Plateau		120 < CDD < 600
Zone 4 **High Mountain**	Littoral side +1400m	HDD > 2000 CDD = 0
	Inland side +1150 m	HDD > 1800 0 < CDD < 120

Thermal Transmittance Calculation (U-value)

The U-value is a measure of how much heat flows through a given thickness of a particular material, and includes the three major ways in which heat transfer occurs: conduction, convection and radiation. The U-value of a building envelope element is the inverse of the total thermal resistance which is calculated from the individual thermal resistance of each component/layer of that element. The U-value is calculated according to the following equation:

$$\boldsymbol{U} = \frac{\mathbf{1}}{\boldsymbol{R_t}} = \frac{\mathbf{1}}{\boldsymbol{R_{se}} + \sum \boldsymbol{R_i} + \boldsymbol{R_{si}}} = \frac{\mathbf{1}}{\boldsymbol{R_{se}} + \sum \frac{\boldsymbol{e_i}}{\boldsymbol{\lambda_i}} + \boldsymbol{R_{si}}}$$

Where:

$\boldsymbol{U}$ = Thermal transmittance of the building envelope component (W/m^2. K)

$\boldsymbol{R_t}$ = Total thermal resistance (m^2.K/W)

$\boldsymbol{R_{se}}$= Exterior surface thermal resistance of air film (m^2.K/W)

$\boldsymbol{R_i}$ = Thermal resistance of each layer of material of air film (m^2.K/W)

$\boldsymbol{R_{si}}$ = Interior surface thermal resistance (m^2.K/W)

$\boldsymbol{e_i}$ = Thickness of each layer of material (m)

$\boldsymbol{\lambda_i}$ = Thermal conductivity of each layer of material (W/m. K)

Air surface layer resistance can be obtained from the following table, which is an extract from EN ISO 6946 Building Components and Building Elements.

Table 11.2.1-2. Air Surface Layer Resistance (m^2.K/W)

Surface Resistance (m^2.K/W)	Direction of Heat Flow		
	Upwards	Horizontal	Downwards
R_{si}	0.1	0.13	0.17
R_{se}	0.04	0.04	0.04
R_t	0.14	0.17	0.21

A) Maximum Thermal Transmittance of External Walls

To demonstrate that the thermal transmittance or the “U-value” of the external walls of a designed building meets the maximum tabulated reference value of the thermal transmittance of external walls as per the different range values of Window to Wall Ratio "WWR" and climate zone type presented in the table hereunder. These values represent the average value of a specific "WWR" range value, and are for indication purposes only. The exact U-value is specifically calculated on the ARZ portal according to the specific value of "WWR" (not as a range of "WWR") and the climate zone.

Table 11.2.1-3. Maximum Thermal Transmittance of External Walls (W/m^2.K)

WWR (%)	Climate Zone - 1	Climate Zone - 2	Climate Zone - 3	Climate Zone - 4
	U-wall	U-wall	U-wall	U-wall
1% - 5%	0.69	0.46	0.46	0.35
6% - 10%	0.68			
11% - 15%	0.67	0.45	0.45	0.34
16% - 20%	0.66			
21% - 25%	0.65	0.44	0.44	0.33
26% - 30%	0.64			
31% - 35%	0.63	0.43	0.43	0.32
36% - 40%	0.62			
41% - 45%	0.61	0.42	0.42	0.31
46% - 50%	0.60			
51% - 55%	0.59	0.41	0.41	0.30
56% - 60%	0.58			
61% - 65%	0.57	0.40	0.40	0.29
66% - 70%	0.56			
71% - 75%	0.55	0.39	0.39	0.28
76% - 80%	0.54			
81% - 85%	0.53	0.38	0.38	0.27
86% - 90%	0.52			
91% - 95%	0.51	0.37	0.37	0.26
96% - 100%	0.50			

Where

Window to Wall Ratio

The window to wall ratio of a building is the ratio of the window area to the total gross wall area (opaque surface plus window). Only the walls above ground are considered in this calculation.

$$\boldsymbol{WWR} = \frac{Windows\ Area}{(Windows\ Area + Doors\ Area + \ Opaque\ Walls\ Area)}$$

B) Maximum Thermal Transmittance of Roofs

To demonstrate that the thermal transmittance or the “U-value” of the roofs of a designed building meets the maximum tabulated reference value of the thermal transmittance of roofs presented in the following table as per the different range values of Skylight to Roof Ratio “SRR” and climate zone type. These values represent the average value of a specific range value of “SRR”, and are for indication purposes only. The exact U-value is specifically calculated on the ARZ portal according to specific value of “SRR” (not as a range of “SRR”) and the climate zone.

Table 11.2.1-4. Maximum Thermal Transmittance of Roofs (W/m^2.K)

SRR (%)	Climate Zone - 1	Climate Zone - 2	Climate Zone - 3	Climate Zone - 4
	U-roof	U-roof	U-roof	U-roof
1% - 10%	0.35	0.35	0.35	0.31
11% - 20%	0.34	0.34	0.34	0.30
21% - 30%	0.33	0.33	0.33	0.29
31% - 40%	0.32	0.32	0.32	0.28
41% - 50%	0.31	0.31	0.31	0.27
51% - 60%	0.30	0.30	0.30	0.26
61% - 70%	0.29	0.29	0.29	0.25
71% - 80%	0.28	0.28	0.28	0.24
81% - 90%	0.27	0.27	0.27	0.23
91% - 100%	0.26	0.26	0.26	0.22

Where

Skylight to Roof Ratio

A Skylight to Roof Ratio (SRR) can be defined in the following equation:

$$\boldsymbol{SRR} = \frac{Skylight\ Area}{(Skylight\ Area\ +\ Opaque\ Roof\ Area)}$$

C) Maximum Thermal Transmittance of Exposed Floors and Semi-Exposed Floors

To demonstrate that the thermal transmittance or the “U-value” of the exposed floors and the semi-exposed floors of a designed building meets the maximum tabulated reference value of thermal transmittance of the exposed floors and the semi-exposed floors presented in the table hereunder as per the floor type.

Table 11.2.1-5. Maximum Thermal Transmittance of Exposed Floors and Semi-exposed Floors (W/m^2.K)

Floor Type	Climate Zone - 1	Climate Zone - 2	Climate Zone - 3	Climate Zone - 4
	U-floor	U-floor	U-floor	U-floor
Exposed Floor	0.29	0.29	0.29	0.21
Semi-exposed Floor	0.99	0.39	0.39	0.39

D) Minimum Thermal Resistance and Minimum Width of Insulation Layer for Slabs on Ground

To demonstrate that the minimum thermal resistance and the minimum width of an insulation layer placed on the perimeter of the slab on the ground of a designed building meet the maximum tabulated reference value of the minimum thermal resistance and the minimum width of the insulation presented in the table hereunder as per a different climate zone type.

Table 11.2.1-6. Minimum Thermal Resistance and Minimum Width of Insulation Layer for Slabs-on-Grade

Insulation for Slabs-on- Grade	Climate Zone - 1	Climate Zone - 2	Climate Zone - 3	Climate Zone - 4
Minimum Thermal Resistance (m^2.K/W)	Not Required	0.75	1.00	1.25
Minimum Insulation Width (m)	Not Required	1.00	1.25	1.5

11.2.1.5 Special Requirements

None

11.2.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.2.1-7. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Architectural Drawings of the color-coded elevations and the sections should come with a legend highlighting the area and the types of external walls, roofs, floors, slabs-on-grade, windows and skylights. • The As-built Architectural Drawings of the external walls, roofs, floors, slabs-on-grade section should include details showing the material of each layer, its type, its thickness and its thermal characteristics.
Specifications	• The Specifications should include the material composition with the thermal characteristics. (i.e., material conductivity/resistance, U-value) of the external walls, roofs, floors and slabs-on-grade.
Calculations	• The Calculations of the weighted average “U-value” of the external walls, roofs, floors, and the minimum thermal resistance with the minimum width of the slabs-on- grade insulation should be performed on the ARZ portal.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Architectural Drawings of the color-coded elevations and the sections should come with a legend highlighting the area and the types of external walls, roofs, floors, slabs-on-grade, windows and skylights. • The As-built Architectural Drawings of the external walls, roofs, floors, slabs on grade section should include details showing the material of each layer, its type, its thickness and its thermal characteristics.
Manufacturer Datasheets	• The Manufacturer Datasheets should include the material composition with the thermal characteristics. (i.e., material conductivity/resistance, U-value) of the external walls, roofs, floors and slabs-on-grade.
Calculations	• The Updated Calculations (if different from Design Phase)
Existing Building	

Submittal Name	Submittal Description
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Architectural Drawings of the color-coded elevations and the sections should come with a legend highlighting the area and the types of external walls, roofs, floors, slabs-on-grade, windows and skylights. • The As-built Architectural Drawings of the external walls, roofs, floors, slabs-on-grade section should include details showing the material of each layer, its type, its thickness and its thermal characteristics.
Manufacturer Datasheets	• The Manufacturer Datasheets should include the material composition with the thermal characteristics. (i.e., material conductivity/resistance, U-value) of the external walls, roofs, floors and slabs-on-grade.
Calculations	• The Calculations of the weighted average “U-value” of the external walls, roofs, floors, and the minimum thermal resistance with the minimum width of the slabs-on- grade insulation should be performed on the ARZ portal.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.2.1.7 Score Allocation

The score for this criterion is determined based on the Opaque Thermal Transmittance requirement. Note that the Opaque Thermal Transmittance requirement for external walls, roofs, floors, or minimum insulation widths and resistance values of slab-on-grade floors should achieve at least the targeted values in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \left[\left(\frac{(A_1 \times S_1) + (A_2 \times S_2) + (A_3 \times S_3) + (A_4 \times S_4)}{A_1 + A_2 + A_3 + A_4}\right) \times 0.9\right] + [S_5 \times 0.1]$$

Where:

$\boldsymbol{A_1}$**:** External wall total area (m^2)

$\boldsymbol{A_2}$**:** Roof total area (m^2)

$\boldsymbol{A_3}$**:** Exposed floor total area (m^2)
$\boldsymbol{A_4}$**:** Semi-exposed floor total area (m^2)

As determined in the tables hereunder,

$\boldsymbol{S_1}$**:** External wall thermal transmittance score
$\boldsymbol{S_2}$**:** Roof thermal transmittance score
$\boldsymbol{S_3}$**:** Exposed floor thermal transmittance score
$\boldsymbol{S_4}$**:** Semi-exposed floor thermal transmittance score
$\boldsymbol{S_5}$**:** Slab-on-grade floor thermal resistance score

Table 11.2.1-8. Score "S1" for the External Wall Thermal Transmittance Requirement

External Wall Thermal Transmittance Requirement	Score “ $\boldsymbol{S_1}$”
$U_{W\,(Design)} > U_{W\,(Target)}$	0%
$U_{W\,(Design)} = U_{W\,(Target)}$	60%
$U_{W\,(Target)} \geq U_{W\,(Design)} \geq 0.5 \times U_{W\,(Target)}$	60% $\leq \boldsymbol{S_1} \leq$ 100%

Where:

$U_{W\,(Design)}$ = Weighted average of designed External Wall Thermal Transmittance $(W/m^2.K)$

$U_{W\,(Target)}$ = Weighted average of targeted External Wall Thermal Transmittance $(W/m^2.K)$

Table 11.2.1-9. Score "S2" for the Roof Thermal Transmittance Requirement

Roof Thermal Transmittance Requirement	Score “ $\boldsymbol{S_2}$”
$U_{R\,(Design)} > U_{R\,(Target)}$	0%
$U_{R\,(Design)} = U_{R\,(Target)}$	60%
$U_{R\,(Target)} \geq U_{R\,(Design)} \geq 0.5 \times U_{R\,(Target)}$	60% $\leq \boldsymbol{S_2} \leq$ 100%

Where:

$U_{R\,(Design)}$ = Weighted average of designed Roof Thermal Transmittance $(W/m^2.K)$

$U_{R\,(Target)}$ = Weighted average of targeted Roof Thermal Transmittance $(W/m^2.K)$

Table 11.2.1-10. Score "S3" for the Exposed Floor Thermal Transmittance Requirement

Exposed Floor Thermal Transmittance Requirement	Score “ S_3”
$U_{EF\,(Design)} > U_{EF\,(Target)}$	0%
$U_{EF\,(Design)} = U_{EF\,(Target)}$	60%
$U_{EF\,(Target)} \geq U_{EF\,(Design)} \geq 0.5 \times U_{EF\,(Target)}$	60% ≤ $\boldsymbol{S_3}$ ≤ 100%

Where:

$U_{EF\,(Design)}$ = Weighted average of designed Exposed Floor Thermal Transmittance $(W/m^2.K)$

$U_{EF\,(Target)}$ = Weighted average of targeted Exposed Floor Thermal Transmittance $(W/m^2.K)$

Table 11.2.1-11. Score "S4" for the Semi-Exposed Floor Thermal Transmittance Requirement

Semi-Exposed Floor Thermal Transmittance Requirement	Score “ S_4”
$U_{SF\,(Design)} > U_{SF\,(Target)}$	0%
$U_{SF\,(Design)} = U_{SF\,(Target)}$	60%
$U_{SF\,(Target)} \geq U_{SF\,(Design)} \geq 0.5 \times U_{SF\,(Target)}$	60% ≤ $\boldsymbol{S_4}$ ≤ 100%

Where:

$U_{SF\,(Design)}$ = Weighted average of designed Semi-Exposed Floor Thermal Transmittance $(W/m^2.K)$

$U_{SF\,(Target)}$ = Weighted average of targeted Semi-Exposed Floor Thermal Transmittance $(W/m^2.K)$

Table 11.2.1-12. Score "S5" for the Slab- on- Grade Floor Thermal Transmittance Requirement

Slab on Grade Floor Thermal Resistance Requirement	Score “ S_5”
$R_{INS(Design)} < R_{INS(Target)}$ and/or $W_{INS(Design)} < W_{INS(Target)}$	0%
$R_{INS(Design)} \geq R_{INS(Target)}$ and $W_{INS(Design)} \geq W_{INS(Target)}$	100%

Where:

$R_{INS(Design)}$ =The designed minimum resistance of insulation for each Slab-on-grade $(m^2.K/\mathrm{W})$

$R_{INS(Target)}$ =The targeted minimum resistance of insulation for each Slab-on-grade $(m^2.K/\mathrm{W})$

$W_{INS(Design)}$ = The designed minimum Width of insulation for each Slab-on-grade $(m^2.K/\mathrm{W})$

$W_{INS(Target)}$ = The targeted minimum Width of insulation for each Slab-on-grade $(m^2.K/\mathrm{W})$

If all external walls, roofs, exposed floors and semi-exposed floors have a designed U-value more than the targeted U-value, and at least one slab-on-grade floor type has a minimum insulation width and a resistance less than the targeted minimum insulation width or resistance, then the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all external walls, roofs, exposed floors and semi-exposed floors have a designed “U-value” equal to half of the targeted “U-value”, and all the slab-on-grade floors have a minimum insulation width and resistance equal to or more than the targeted minimum insulation width and resistance.

11.2.2En-2.2: Glass Thermal Transmittance and Solar Performance

11.2.2.1 Criterion Reference and Title

En-2.2: Glass Thermal Transmittance and Solar Performance

11.2.2.2 Criterion Type

Optional

11.2.2.3 Intent

To support a proper building envelope design for Glass Thermal Transmittance and Solar Performance, and to select and install specific types with proper thermal and physical parameters as per the specific climate zones, which helps reduce the energy consumption of the building.

11.2.2.4 General Requirements

A) Maximum Glass Thermal Transmittance and Solar Performance for Windows

To demonstrate that the Glass Thermal Transmittance or the “U-value” and the solar heat gain coefficient “SHGC”of the windows of a designed building meet a maximum average tabulated reference value of the “U-value” and the“SHGC” presented in the following table as per the different range values of Window to Wall Ratio “WWR” and the climate zone type. These values represent the average value for a specific range value of “WWR”. They are for indication purposes only. The exact “U-value” and the “SHGC” are exactly calculated on the ARZ portal as per the specific value of “WWR” (not as range of “WWR”) and the climate zone.

Table 11.2.2-1. Maximum Glass Thermal Transmittance (W/m^2.K) and Solar Performance for Windows

WWR (%)	Climate Zone - 1		Climate Zone - 2		Climate Zone - 3		Climate Zone - 4	
	U	SHGC	U	SHGC	U	SHGC	U	SHGC
1% - 5%	3.50	0.25	3.0	0.39	3.0	0.39	2.70	0.39
6% - 10%	3.40		2.90		2.90		2.60	
11% - 15%	3.30		2.80	0.25	2.80	0.25	2.50	
16% - 20%	3.20		2.70		2.70		2.40	
21% - 25%	3.10		2.60		2.60		2.30	
26% - 30%	3.00		2.50		2.50		2.20	
31% - 35%	2.90		2.40		2.40		2.10	
36% - 40%	2.80		2.30		2.30		2.00	
41% - 45%	2.70	0.20	2.20	0.20	2.20	0.20	1.90	0.25

46% - 50%	2.60		2.10		2.10		1.80	
51% - 55%	2.50		2.00		2.00		1.70	
56% - 60%	2.40		1.90		1.90		1.60	
61% - 65%	2.30		1.80		1.80		1.50	
66% - 70%	2.20		1.70		1.70		1.40	
71% - 75%	2.10	0.15	1.60		1.60		1.30	0.20
76% - 80%	2.00		1.50		1.50		1.20	
81% - 85%	1.90		1.40	0.15	1.40	0.15	1.10	
86% - 90%	1.80		1.30		1.30		1.00	
91% - 95%	1.70		1.20		1.20		0.90	
96% - 100%	1.60		1.10		1.10		0.80	

B) Maximum Glass Thermal Transmittance and Solar Performance for Skylights

To demonstrate that the Glass Thermal Transmittance or the “U-value” and the solar heat gain coefficient “SHGC” of the skylights of a designed building meet a maximum tabulated reference value of the “U-value” and the “SHGC” of skylights presented in the following table as per the different range values of Sky to Roof Ratio “SRR” and the climate zone type. These values represent the average value for a specific range value of “SRR”. They are for indication purposes only. The exact “U-value” and the “SHGC” are exactly calculated on the ARZ portal asper the specific value of “SRR” (not as range of “SRR”) and the climate zone.

Table 11.2.2-2. Maximum Glass Thermal Transmittance (W/m^2.K) and Solar Performance for Skylights

SRR (%)	**Climate Zone - 1**		**Climate Zone - 2**		**Climate Zone - 3**		**Climate Zone - 4**	
	U	**SHGC**	**U**	**SHGC**	**U**	**SHGC**	**U**	**SHGC**
1% - 2%	3.50	0.19	3.0	0.36	3.0	0.36	2.70	0.36
3% - 5%	3.50	0.19	3.0	0.19	3.0	0.19	2.70	0.19
6% - 10%	3.40		2.90		2.90		2.60	
11% - 15%	3.30		2.80		2.80		2.50	
16% - 20%	3.20		2.70		2.70		2.40	
21% - 25%	3.10		2.60		2.60		2.30	
26% - 30%	3.00		2.50		2.50		2.20	
31% - 35%	2.90		2.40		2.40		2.10	
36% - 40%	2.80		2.30		2.30		2.00	
41% - 45%	2.70		2.20		2.20		1.90	
46% - 50%	2.60		2.10		2.10		1.80	

51% - 55%	2.50		2.00		2.00		1.70	
56% - 60%	2.40		1.90		1.90		1.60	
61% - 65%	2.30		1.80		1.80		1.50	
66% - 70%	2.20		1.70		1.70		1.40	
71% - 75%	2.10		1.60		1.60		1.30	
76% - 80%	2.00		1.50		1.50		1.20	
81% - 85%	1.90		1.40		1.40		1.10	
86% - 90%	1.80		1.30		1.30		1.00	
91% - 95%	1.70		1.20		1.20		0.90	
96% - 100%	1.60		1.10		1.10		0.80	

C) Glass Solar Performance in Detail

The relation between the “$\boldsymbol{SHGC}$” and the “$\boldsymbol{SC}$” is expressed as per the following equations:

$$\boldsymbol{SHGC = SC \times 0.87 \qquad ; \qquad SC = SHGC / 0.87}$$

The Shading Coefficient to be considered is only that of the glazing, and should not consider any movable or removable shading devices such as venetian blinds or roller shades. The glass Shading Coefficients “SC” or Solar Heat Gain Coefficient “SHGC” can normally be obtained from the manufacturer’s documentation. The Shading Coefficient of glass is affected by (1) the glass characteristics (tinted, reflective), (2) the number of its layers, (3) its clarity, and (4) its coatings.

When overhangs or/and fins exist, the window “SHGC” can be adjusted (reduced) and calculated according to the following equation:

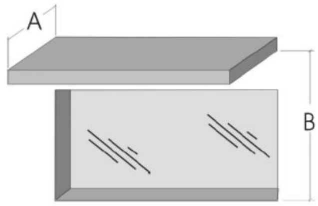
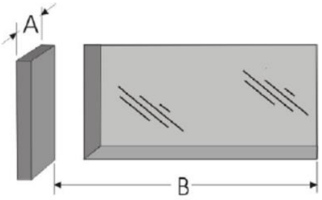
$$\boldsymbol{SHGC_{-\,Adjusted} = \sum (A_{Wi} \times SHGC_{Wi} \times ASF_{Wi}) / A_W}$$

$\boldsymbol{A_{Wi}}$ = Individual window area (m^2)
$\boldsymbol{SHGC_{Wi}}$ = Individual window solar heat gain coefficient
$\boldsymbol{ASF_{Wi}}$ = Individual window architectural shading factor (as described hereunder in detail)
$\boldsymbol{A_W}$ = Area of all vertical windows in all orientations

Projection Factor of Shading Device

The projection factor for overhangs or fins is expressed as a dimensionless ratio defined as follows:

Table 11.2.2-3. Projection Factor of Shading Device

PROJECTION FACTOR FOR OVERHANGS	PROJECTION FACTOR FOR FINS
$PF_{overhang} = A / B$	$PF_{fin} = A / B$
	
$PF_{overhang}$ = Projection factor for overhangs A = Horizontal extension of the overhang from the vertical wall plane which contains the fenestration(m) B = Distance between the bottom edge of the fenestration and the bottom edge of the overhang (m)	PF_{fin} = Projection factor for fins A = Horizontal extension of the fin from the vertical wall plane which contains the fenestration (m) B = Distance between the farthest side of the fenestration to the face of fin closest to the fenestration(m)

Architectural Shading Factor (ASF)

The Architectural Shading Factor (ASF) is a coefficient related to the external shading projection factor of overhangs and / or lateral fins. The values of the Architectural Shading Factor (ASF) can be found in the following tables depending on the Projection Factor (PF) of the architectural shading device. The value with the closest fit to the actual projection of the overhang and/or fins should be used in case the dimensions of the projection factor from the following table do not exactly fit the ratio of overhang and/or fins.

Table 11.2.2-4. Architectural Shading Factor (ASF) for Windows Protected by Overhangs Only

PF	ASF per orientation for Overhang			
	N	NE,NW	E,W	S,SE,SW
$0.05 \leq PF < 0.15$	0.24	0.43	0.74	0.89
$0.15 \leq PF < 0.30$	0.23	0.40	0.68	0.80
$0.30 \leq PF < 0.50$	0.21	0.34	0.57	0.64
$0.50 \leq PF < 0.70$	0.19	0.31	0.49	0.54
$0.70 \leq PF < 0.90$	0.18	0.28	0.43	0.46
$0.90 \leq PF < 1.25$	0.17	0.26	0.38	0.41
$PF \geq 1.25$	0.16	0.24	0.31	0.34

Table 11.2.2-5. Architectural Shading Factor (ASF) for Windows Protected by Fins Only

PF	**ASF per orientation for Overhang**			
	N	**NE,NW**	**E,W**	**S,SE,SW**
$0.05 \leq PF < 0.15$	0.23	0.42	0.76	0.92
$0.15 \leq PF < 0.25$	0.20	0.38	0.71	0.85
$0.25 \leq PF < 0.35$	0.19	0.35	0.67	0.78
$PF \geq 0.35$	0.17	0.32	0.63	0.74

Table 11.2.2-6. Architectural Shading Factor (ASF) for Windows Protected by Fins and Overhangs

PF	**ASF per orientation for Overhangs and Fins**			
	N	**NE,NW**	**E,W**	**S,SE,SW**
Overhangs : $0.05 \leq PF < 0.30$ **Fins: $0.05 \leq PF < 0.15$**	0.20	0.35	0.63	0.72
Overhangs : $0.30 \leq PF < 0.60$ **Fins: $0.15 \leq PF < 0.30$**	0.15	0.26	0.47	0.50
Overhangs : $0.60 \leq PF < 1.05$ **Fins: $0.30 \leq PF < 0.50$**	0.11	0.17	0.30	0.27
Overhangs : $PF \geq 1.05$ **Fins: $PF \geq 0.50$**	0.08	0.11	0.17	0.13

11.2.2.5 Special Requirements

None

11.2.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.2.2-7. Required Submittals

Submittal Name	**Submittal Description**
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
Drawings	• The Architectural Drawings of the color-coded elevations and sections should come with a legend highlighting the area and the types of windows and skylights. • The section on windows and skylights in the Architectural Drawings should include details about the glass showing the number of layers, its type, its thickness and its thermal characteristics.
Specifications	• The Specifications of windows should include their shading and composition, the number of glass layers, the glass type, its thickness and its thermal characteristics (U-value and SHGC).
Calculations	• The Calculations of the weighted average “U-value” and the adjusted “SHGC” for windows and skylights should be performed as per the ARZ portal.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Architectural Drawings of the color-coded elevations and the sections should come with a legend highlighting the area and the types of windows and skylights. • The section in the As-built Architectural Drawings of the windows and the skylights should include details about the number of layers of glass, the glass type, its thickness and its thermal characteristics.
Manufacturer Datasheets	• The Manufacturer Datasheets of windows should include their shading and composition, the number of glass layers, the glass type, its thickness and its thermal characteristics (“U-value” and “SHGC”).
Calculations	• The updated calculation (if different from Design Phase)
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Architectural Drawings of the color-coded elevations and the sections should come with a legend highlighting the area and the types of windows and skylights.

Submittal Name	Submittal Description
	• The section in the As-built Architectural Drawings of the windows and the skylights should include details about the number of layers of glass, the glass type, its thickness and its thermal characteristics.
Datasheets	• The Manufacturer Datasheets of windows should include their shading and composition, the number of glass layers, the glass type, its thickness and its thermal characteristics ("U-value" and "SHGC").
Calculations	• The Calculations of the weighted average "U-value" and the adjusted "SHGC" of windows and skylights should be performed as per the ARZ portal.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.2.2.7 Score Allocation

The score for this criterion is determined based on the Glass Thermal Transmittance and the Solar Performance Requirement. Note that the Glass Thermal Transmittance and the Solar Performance Requirement of windows and/or skylights should be at least performed in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \frac{[A_1 \times ((S_1 + S_2)/2)] + [A_2 \times ((S_3 + S_4)/2)]}{(A_1 + A_2)}$$ Where:

$\boldsymbol{A_1}$: Total area of windows (m^2)

$\boldsymbol{A_2}$: Total area of skylights (m^2)

As determined in the tables hereunder,

$\boldsymbol{S_1}$: Score for Glass Thermal Transmittance of windows

$\boldsymbol{S_2}$: Score for Glass Solar Performance of windows

$\boldsymbol{S_3}$: Score for Glass Thermal Transmittance of skylights

$\boldsymbol{S_4}$: Score for Glass Solar Performance of skylights

Table 11.2.2-8. Score "S1" for Glass Thermal Transmittance of Windows Requirement

Glass Thermal Transmittance for Windows Requirement	Score “ S_1”
$U_{WIN\,(Design)} > U_{WIN\,(Target)}$	0%
$U_{WIN\,(Design)} = U_{WIN\,(Target)}$	60%
$U_{WIN\,(Target)} \geq U_{WIN\,(Design)} \geq 0.5 \times U_{WIN\,(Target)}$	60% ≤ $\boldsymbol{S_1}$ ≤ 100%

Where:

$U_{WIN\,(Design)}$ = Weighted average of the designed Glass Thermal Transmittance of windows

$U_{WIN\,(Target)}$ = Weighted average of the targeted Glass Thermal Transmittance of windows

Table 11.2.2-9. Score "S2" for the Solar Performance of Windows Requirement

Solar Performance for Windows Requirement	Score “ S_2”
$SHGC_{W\,(Dsign)} > SHGC_{WIN\,(Target)}$	0%
$SHGC_{WIN\,(Design)} = SHGC_{WIN\,(Target)}$	60%
$SHGC_{WIN\,(Target)} \geq SHGC_{WIN\,(Design)} \geq 0.5 \times SHGC_{WIN\,(Target)}$	60% ≤ $\boldsymbol{S_2}$ ≤ 100%

Where:

$SHGC_{WIN\,(Design)}$ = Weighted average of the designed Glass Solar Performance of windows

$SHGC_{WIN\,(Target)}$ = Weighted average of the targeted Glass Solar Performance of windows

Table 11.2.2-10. Score "S3" for the Glass Thermal Transmittance of skylights Requirement

Glass Thermal Transmittance of Skylights Requirement	Score “ S_3”
$U_{SKY\,(Design)} > U_{SKY\,(Target)}$	0%
$U_{SKY\,(Design)} = U_{SKY\,(Target)}$	60%
$U_{SKY\,(Target)} \geq U_{SKY\,(Design)} \geq 0.5 \times U_{SKY\,(Target)}$	60% ≤ $\boldsymbol{S_3}$ ≤ 100%

Where:

$U_{SKY\,(Design)}$ = Weighted average of the designed Glass Thermal Transmittance of skylights

$U_{SKY\,(Target)}$ = Weighted average of the targeted Glass Thermal Transmittance of skylights

Table 11.2.2-11. Score "S4" for the Solar Performance of skylights Requirement

Solar Performance for Skylights Requirement	**Score "S_4"**
$SHGC_{SKY\,(Design)} > SHGC_{SKY\,(Target)}$	0%
$SHGC_{SKY\,(Design)} = SHGC_{SKY\,(Target)}$	60%
$SHGC_{SKY\,(Target)} \geq SHGC_{SKY\,(Design)} \geq 0.5 \times SHGC_{SKY\,(Target)}$	60% ≤ $\boldsymbol{S_4}$ ≤ 100%

Where:

$SHGC_{SKY\,(Design)}$ = Weighted average of the designed Glass Solar Performance of skylights

$SHGC_{SKY\,(Target)}$ = Weighted average of the targeted Glass Solar Performance of skylights

If all windows and skylights have a designed “U-value” and “SHGC” more than the targeted “U-value” and “SHGC” respectively, then the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all windows and skylights have a designed “U-value” and “SHGC” equal to half of the targeted “U-value” and “SHGC” respectively.

11.2.3En-2.3: Opaque Solar Reflectivity

11.2.3.1 Criterion Reference and Title

En-2.3: Opaque Solar Reflectivity

11.2.3.2 Criterion Type

Optional

11.2.3.3 Intent

To support what reduces the energy consumption of the building, namely a proper building envelope design of the Opaque Solar Reflectivity, and to select and install specific types of materials, paints or finishes with proper solar reflectivity parameters as per the existing climate zoning.

11.2.3.4 General Requirements

Solar Reflectivity (SR)

The Solar Reflectivity (SR) of a specific material and finish can be acquired from the product manufacturer datasheet form based on the laboratory test results. Solar Reflectivity is expressed as a fractional value between 0 and 1.

To reduce the surface temperature, select a high Solar Reflectivity (SR) finished roof and external walls. The Solar Reflectivity (SR) values should be equal to or more than 0.7 $(\mathrm{SR} \geq 0.7)$ for the materials, paints or finishes used. As the solar rays are reflected, the cooling load in the air-conditioned spaces (energy-saving) is minimized and the thermal comfort is improved. The urban heat island effect will be reduced by the same token. In case the building has more than one roof type or wall type, the weighted average Solar Reflectivity (SR) value must be calculated.

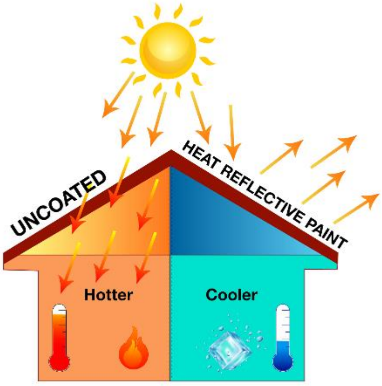


Figure 11.2.3-1. Solar reflectivity effect

11.2.3.5 Special Requirements

None

11.2.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.2.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Architectural drawings of the color-coded elevations and sections should come with a legend highlighting the area, the types of external walls and roofs, and their Solar Reflectivity (SR)values.
Specifications	• The Specifications of the external walls, and the roofs should include the finished material composition and its solar reflectivity values (SR).
Calculations	• The weighted average of the Solar Reflectivity (SR) of the external walls and roofs should be performed in the ARZ •
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Architectural Drawings of the color-coded elevations and sections should come with a legend highlighting the area, the types of external walls and roofs, and their Solar Reflectivity (SR) values.
Manufacturer Datasheets	• The Manufacturer Datasheets of the external walls and roof finishes should include the material composition and the Solar Reflectivity (SR) values.
Calculations	• The updated calculations (if different from the Design Phase)
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Architectural Drawings of the color-coded elevations and sections should come with a legend highlighting the area, the types of external walls and roofs, and their Solar Reflectivity (SR) values.
Manufacturer Datasheets	• The Manufacturer Datasheets of the external walls and roof finishes should include the material composition and the Solar Reflectivity (SR) values.

Submittal Name	Submittal Description
Calculations	• The weighted average of the Solar Reflectivity (SR) of the external walls and roofs should be performed on the ARZ portal.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.2.3.7 Score Allocation

The score for this criterion is determined based on the Opaque Solar Reflectivity requirement. Note that the Opaque Solar Reflectivity requirement for the external walls or roofs should be at least performed in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \frac{(A_1\ \times\ S_1)\ +\ (A_2\ \times\ S_2)}{(A_1\ +\ A_2)}$$

Where:

$\boldsymbol{A_1}$**:** External wall total area (m^2)

$\boldsymbol{A_2}$**:** Roof total area (m^2)

As determined in the tables hereunder,

$\boldsymbol{S_1}$**:** Wall Solar Reflectivity requirement score

$\boldsymbol{S_2}$**:** Roof Solar Reflectivity requirement score

Table 11.2.3-2. Score "S1" for the External Wall Solar Reflectivity Requirement

Solar Reflectivity of External Wall Requirement	Score " S_1"
$SR_{wall} < 0.7$	0%
$SR_{wall} = 0.7$	60%
$0.7 \leq SR_{wall} \leq 1$	60% ≤ $\boldsymbol{S_1}$ ≤ 100%

Table 11.2.3-3. Score "S2" for the Roof Solar Reflectivity Requirement

Roof Solar Reflectivity Requirement	Score “ S_2”
$SR_{roof} < 0.7$	0%
$SR_{roof} = 0.7$	60%
$0.7 \leq SR_{roof} \leq 1$	60% ≤ $\boldsymbol{S_2}$ ≤ 100%

Where:

SR_{wall} = Weighted average of the designed external wall Solar Reflectivity (SR)

SR_{roof} = Weighted average of the designed roof Solar Reflectivity (SR)

If all external walls and roofs have Solar Reflectivity less than or equal to 0.7, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the external walls and roofs have Solar Reflectivity equal to one (SR = 1).

11.3 Family: Heating, Ventilating, Air Conditioning and Refrigeration

11.3.1En-3.1: Cooling Equipment Efficiency

11.3.1.1 Criterion Reference and Title

En-3.1: Cooling Equipment Efficiency

11.3.1.2 Criterion Type

Optional

11.3.1.3 Intent

To support an effective cooling design, and to select and install an efficient cooling system so that ultimate thermal comfort is achieved with minimum energy consumption.

11.3.1.4 General Requirements

An effective cooling design must be complemented with an efficient cooling system. This cooling system must be carefully selected and installed without any undersizing or oversizing to achieve ultimate thermal comfort with minimum energy consumption. The air conditioning system type mentioned in this criterion will cover the following: Unitary and Applied Heat Pumps, Variable Refrigerant Flow Air Conditioners, Packaged Terminal Air Conditioners (PTAC) and Packaged Terminal Heat Pumps (PTHP), Air-Cooled Chillers, and Water-Cooled Chillers.

All types of air conditioning systems must comply with the minimum energy efficiency requirements, and with the test procedures mentioned and listed in the ASHRAE std. 90-1-2019 reference table. For systems including more than one air-conditioning unit, the weighted average energy efficiency calculation (i.e., EER/SEER/IEER/COP/SCOP/IPLV) must be performed on the ARZ.

Table 11.3.1-1. Minimum Efficiency Reference Table of Each Air Conditioning System Type in ASRHAE std. 90.1-2019

Air Conditioning System Type	Minimum Efficiency Reference Table (ASHRAE std. 90.1-2019)
Unitary and Applied Heat Pump	Table G3.5.2
Variable Refrigerant Flow Air Conditioners	Table 6.8.1-9
Packaged Terminal Air Conditioners /Heat Pumps	Table G3.5.4
Air-Cooled Chillers	Table 6.8.1-3
Water-Cooled Chillers	Table G3.5.3

11.3.1.5 Special Requirements

None

11.3.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.3.1-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The AC drawings should show the location for all outdoor and indoor AC units.
Calculations	• The weighted average of the energy efficiency of all the AC units designed in the project should be performed in the ARZ portal.
Specifications	• The Specifications should include all the AC units designed in the project and should specify their energy efficiency values.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built AC drawings should show the location of all the outdoor and the indoor AC units.
Calculations	• The weighted average of the energy efficiency of all the AC units used in the project should be performed on the ARZ.
Manufacturer Datasheets	• The Manufacturer Datasheets should include all the AC units used in the project and should specify their energy efficiency values.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built AC drawings should show the location for all outdoor and indoor AC units.
Calculations	• The weighted average of the energy efficiency of all the AC units used in the project should be performed on the ARZ.

Submittal Name	Submittal Description
Manufacturer Datasheets	• The Manufacturer Datasheets should include all the AC units used in the project and should specify their energy efficiency values.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.3.1.7 Score Allocation

The score for this criterion is determined based on the Cooling Equipment Efficiency requirement. Note that the Design Efficiency Value of one of the Cooling Equipment types should at least achieve the Target Efficiency Value in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \left[\frac{(C_1 \times S_1) + (C_2 \times S_2) + (C_3 \times S_3) + (C_4 \times S_4) + (C_5 \times S_5) + (C_6 \times S_6)}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6}\right]$$

Where:

$\boldsymbol{C_1}$ **:** The Unitary and Applied Heat Pumps (kW) total cooling capacity
$\boldsymbol{C_2}$ **:** The Variable Refrigerant Flow Air Conditioners (VRF) (kW) total cooling capacity
$\boldsymbol{C_3}$ **:** The Packaged Terminal Units (PTAC) & (PTHP) (kW) total cooling capacity
$\boldsymbol{C_4}$ **:** The Air-Cooled Chillers (kW) total cooling capacity
$\boldsymbol{C_5}$ **:** The Water-Cooled Chillers (Rotary Screw and Scroll) (kW) total cooling capacity
$\boldsymbol{C_6}$ **:** The Water-Cooled Chillers (Centrifugal) (kw) total cooling capacity

As determined in the tables hereunder,

$\boldsymbol{S_1}$ **:** The Unitary and Applied Heat Pumps efficiency score
$\boldsymbol{S_2}$ **:** The Variable Refrigerant Flow AC efficiency score
$\boldsymbol{S_3}$ **:** The Packaged Terminal Units efficiency score
$\boldsymbol{S_4}$ **:** The Air-Cooled Chillers determined efficiency score
$\boldsymbol{S_5}$ **:** The Water-Cooled Chillers (Rotary/Scroll) efficiency score
$\boldsymbol{S_6}$ **:** The Water-Cooled Chillers (Centrifugal) efficiency score

If all the cooling equipment has a designed efficiency less than the targeted efficiency, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the cooling equipment has a designed efficiency more than the targeted efficiency.

Unitary and Applied Heat Pumps Efficiency Score Calculation "S_1"

S_1 = Weighted average score of all the Unitary and Applied Heat Pump units

$$S_1 = \left[\frac{\sum_{i=1}^{n}(A_i \times B_i)}{\sum_{i=1}^{n}(A_i)}\right]$$

Where:

A_i = Number of installed Unitary and Applied Heat Pumps

B_i = Efficiency score of each Unitary and Applied Heat Pump as determined in the table hereunder

Table 11.3.1-3. Score "Bi" of the Unitary and Applied Heat Pump Efficiency Requirement

Unitary and Applied Heat Pump Efficiency Requirement	Score " B_i "
$COP_{HP\,(Design)} < COP_{HP\,(Target)}$	0%
$COP_{HP\,(Design)} = COP_{HP\,(Target)}$	60%
$COP_{HP\,(Target)} \leq COP_{HP\,(Design)} \leq 2 \times COP_{HP\,(Target)}$	60% $\leq B_i \leq$ 100%

Where:

$COP_{HP\,(Design)}$ = Each Unitary and Applied Heat Pump designed COP

$COP_{HP\,(Target)}$ = Each Unitary and Applied Heat Pump targeted COP

Variable Refrigerant Flow Air Conditioners Efficiency Score Calculation "S_2"

S_2 = Weighted average score of all Variable Refrigerant Flow Air Conditioners

$$S_2 = \left[\frac{\sum_{i=1}^{n}(C_i \times D_i)}{\sum_{i=1}^{n}(C_i)}\right]$$

Where:

C_i = Number of installed Variable Refrigerant Flow ACs

D_i = Each Variable Refrigerant Flow AC efficiency score as determined in the table hereunder

Table 11.3.1-4. Score "Di" of Variable Refrigerant Flow AC Efficiency Requirement

Variable Refrigerant Flow AC Efficiency Requirement	Score " D_i "
$COP_{VRF\,(Design)} < COP_{VRF\,(Target)}$	0%
$COP_{VRF\,(Design)} = COP_{VRF\,(Target)}$	60%
$COP_{VRF\,(Target)} \leq COP_{VRF\,(Design)} \leq 2 \times COP_{VRF\,(Target)}$	60% ≤ $\boldsymbol{D_i}$ ≤ 100%

Where:

$COP_{VRF\,(Design)}$= Each Variable Refrigerant Flow AC designed COP

$COP_{VRF\,(Target)}$= Each Variable Refrigerant Flow AC targeted COP

Packaged Terminal Air Conditioners/Heat Pumps Efficiency Score Calculation "$\boldsymbol{S_3}$"

$\boldsymbol{S_3}$ = Weighted average score of all the Packaged Terminal units

$$\boldsymbol{S_3} = \left[\frac{\sum_{i=1}^{n}(E_i \times F_i)}{\sum_{i=1}^{n}(E_i)}\right]$$

Where:

$\boldsymbol{E_i}$ = Number of installed Packaged Terminals

$\boldsymbol{F_i}$ = Each Packaged Terminal unit efficiency score as determined in the table hereunder

Table 11.3.1-5. Score "Fi" for the Packaged Terminal Air Conditioners/Heat Pumps Efficiency Requirement

Packaged Terminal Unit Efficiency Requirement	Score " F_i "
$COP_{PT\,(Design)} < COP_{PT\,(Target)}$	0%
$COP_{PT\,(Design)} = COP_{PT\,(Target)}$	60%
$COP_{PT\,(Target)} \leq COP_{PT\,(Design)} \leq 2 \times COP_{PT\,(Target)}$	60% ≤ $\boldsymbol{F_i}$ ≤ 100%

Where:

$COP_{PT\,(Design)}$= Each Packaged Terminal unit designed COP

$COP_{PT\,(Target)}$= Each Packaged Terminal unit targeted COP

Air-cooled Chillers Efficiency Score Calculation "$\boldsymbol{S_4}$"

$\boldsymbol{S_4}$ = Weighted average score of all Air-cooled Chillers

$$S_4 = \left[\frac{\sum_{i=1}^{n}\left[G_i \times ((H_i + I_i)/2)\right]}{\sum_{i=1}^{n}(G_i)}\right]$$

Where:

G_i = Number of installed Air-cooled Chillers

As determined in the tables hereunder,

H_i = COP score of each Air-Cooled Chiller unit I_i = IPLV score of each Air-Cooled Chiller Unit

Table 11.3.1-6. Score "Hi" for the Air-Cooled Chillers Efficiency "COP" Requirement

Air-Cooled Chillers Efficiency "COP" Requirement	Score " H_i "
$COP_{AC\,(Design)} < COP_{AC\,(Target)}$	0%
$COP_{AC\,(Design)} = COP_{AC\,(Target)}$	60%
$COP_{AC\,(Target)} \leq COP_{AC\,(Design)} \leq 2 \times COP_{AC\,(Target)}$	60% ≤ H_i ≤ 100%

Where:

$COP_{AC\,(Design)}$= Each Air-cooled Chiller designed COP

$COP_{AC\,(Target)}$= Each Air-cooled Chiller targeted COP

Table 11.3.1-7. Score "Ii" for the Air-Cooled Chillers Efficiency "IPLV" Requirement

Air-Cooled Chillers Efficiency "IPLV" Requirement	Score " I_i "
$IPLV_{AC\,(Design)} < IPLV_{AC\,(Target)}$	0%
$IPLV_{AC\,(Design)} = IPLV_{AC\,(Target)}$	60%
$IPLV_{AC\,(Target)} \leq IPLV_{AC\,(Design)} \leq 2 \times IPLV_{AC\,(Target)}$	60% ≤ I_i ≤ 100%

Where:

$IPLV_{AC\,(Design)}$= Each Air-cooled Chiller designed IPLV

$IPLV_{AC\,(Target)}$= Each Air-cooled Chiller targeted IPLV

Water-Cooled Chillers (Rotary Screw and Scroll) Efficiency Score Calculation "S_5"

S_5 = Weighted average score of all Water-cooled Chillers (Rotary Screw and Scroll)

$$\boldsymbol{S_5} = \left[\frac{\sum_{i=1}^{n}\left[J_i \times ((K_i + L_i)/2)\right]}{\sum_{i=1}^{n}(J_i)}\right]$$

Where:

$\boldsymbol{J_i}$ = Number of installed Water-cooled Chillers

As determined in the tables hereunder,

$\boldsymbol{K_i}$ = COP score of each Water-cooled Chiller

$\boldsymbol{L_i}$ = IPLV score of each Water-cooled Chiller

Table 11.3.1-8. Score "Ki" for the Water-Cooled Chillers (Rotary Screw and Scroll) "COP" Efficiency Requirement

Water-Cooled Chillers Efficiency "COP" Requirement	Score " $\boldsymbol{K_i}$ "
$COP_{WC1(Design)} < COP_{WC1(Target)}$	0%
$COP_{WC1(Design)} = COP_{WC1(Target)}$	60%
$COP_{WC1(Target)} \leq COP_{WC1(Design)} \leq 2 \times COP_{WC1(Target)}$	60% ≤ $\boldsymbol{K_i}$ ≤ 100%

Where:

$COP_{WC1(Design)}$= Each Water-cooled Chiller designed COP (Rotary Screw and Scroll)

$COP_{WC1(Target)}$= Each Water-cooled Chiller targeted COP (Rotary Screw and Scroll)

Table 11.3.1-9. Score "Li" for the Air-Cooled Chillers (Rotary Screw and Scroll) "IPLV" Efficiency Requirement

Air-Cooled Chillers Efficiency "IPLV" Requirement	Score " $\boldsymbol{L_i}$ "
$IPLV_{WC1(Design)} < IPLV_{WC1(Target)}$	0%
$IPLV_{WC1(Design)} = IPLV_{WC1(Target)}$	60%
$IPLV_{WC1(Target)} \leq IPLV_{WC1(Design)} \leq 2 \times IPLV_{WC1(Target)}$	60% ≤ $\boldsymbol{L_i}$ ≤ 100%

Where:

$IPLV_{WC1(Design)}$= Each Water-Cooled Chiller designed IPLV (Rotary Screw/Scroll)

$IPLV_{WC1(Target)}$= Each Water-Cooled Chiller targeted IPLV (Rotary Screw/Scroll)

Water-Cooled Chillers (Centrifugal) Efficiency Score Calculation "$\boldsymbol{S_6}$"

$\boldsymbol{S_6}$ **=** Weighted average score of all Water-cooled Chillers (Centrifugal)

$$\boldsymbol{S_6} = \left[\frac{\sum_{i=1}^{n}\left[M_i \times ((N_i + O_i)/2)\right]}{\sum_{i=1}^{n}(O_i)}\right]$$

Where:

$\boldsymbol{M_i}$ = Number of installed Water-cooled Chillers (Centrifugal)

As determined in the tables hereunder,

$\boldsymbol{N_i}$ = COP score of each Water-cooled Chiller (Centrifugal)

$\boldsymbol{O_i}$ = IPLV score of each Water-cooled Chiller (Centrifugal)

Table 11.3.1-10. Score "Ni" for the Water-Cooled Chillers' (Centrifugal) "COP" Efficiency Requirement

Water-Cooled Chillers' Efficiency "COP" Requirement	Score " $\boldsymbol{N_i}$ "
$COP_{WC2(Design)} < COP_{WC2(Target)}$	0%
$COP_{WC2(Design)} = COP_{WC2(Target)}$	60%
$COP_{WC2(Target)} \leq COP_{WC2(Design)} \leq 2 \times COP_{WC2(Target)}$	60% ≤ $\boldsymbol{N_i}$ ≤ 100%

Where:

$COP_{WC2(Design)}$= Each Water-cooled Chiller (Centrifugal)designed COP

$COP_{WC2(Target)}$= Each Water-cooled Chiller (Centrifugal)targeted COP

Table 11.3.1-11. Score "Oi" for the Water-Cooled Chillers' "IPLV" Efficiency Requirement

Water-Cooled Chillers' Efficiency "IPLV" Requirement	Score " $\boldsymbol{O_i}$ "
$IPLV_{WC2(Design)} < IPLV_{WC2(Target)}$	0%
$IPLV_{WC2(Design)} = IPLV_{WC2(Target)}$	60%
$IPLV_{WC2(Target)} \leq IPLV_{WC2(Deign)} \leq 2 \times IPLV_{WC2(Target)}$	60% ≤ $\boldsymbol{O_i}$ ≤ 100%

Where:

$IPLV_{WC2(Design)}$= Each Water-cooled Chiller (Centrifugal) designed IPLV

$IPLV_{WC2(Target)}$= Each Water-cooled Chiller (Centrifugal) targeted IPLV

11.3.2En-3.2: Heating Equipment Efficiency

11.3.2.1 Criterion Reference and Title

En-3.2: Heating Equipment Efficiency

11.3.2.2 Criterion Type

Optional

11.3.2.3 Intent

To support an effective heating design, and to select and install an efficient heating system so that maximum thermal comfort is achieved with minimum energy consumption.

11.3.2.4 General Requirements

A proper and effective heating design must be complemented with an efficient heating system. This heating system must be carefully selected and installed without any undersizing or oversizing to achieve ultimate thermal comfort with minimum energy consumption. The heating system type mentioned in this criterion will cover the following: Warm-air Furnaces, Unit Heaters, and Gas-and Oil-fired Boilers.

All heating systems must comply with (1) the minimum energy efficiency requirements, and (2) the test procedures mentioned and listed in the table hereunder as in the ASHRAE std. 90-1-2019 reference table hereunder. As to the systems including more than one heating unit, the weighted average energy efficiency calculations (i.e., AFUE, E_t, E_c, etc.) must be performed in the ARZ portal.

Table 11.3.2-1. Minimum Efficiency Reference Table for Each Heating System Type in ASHRAE std. 90-1-2019

Heating System Type	**Minimum Efficiency Reference Table (ASHRAE std. 90.1-2019)**
Warm-air Furnaces and Unit Heaters	Table G3.5.5
Gas- and Oil-fired Boilers	Table G3.5.6

11.3.2.5 Special Requirements

None

11.3.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.3.2-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Heating Drawings should show the location of all the heating units.
Calculations	• The weighted average of the Energy Efficiency of all the heating units designed in the project should be performed on the ARZ.
Specifications	• The Specifications should mention all the heating units designed in the project and should specify their Energy Efficiency values.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Heating Drawings should show the location of all the heating units.
Calculations	• The weighted average of the Energy Efficiency of all the heating units used in the project should be performed on the ARZ.
Manufacturer Datasheets	• The Manufacturer Datasheets should include all the heating units used in the project and should specify their Energy Efficiency values.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Heating Drawings should show the location of all the heating units.

Submittal Name	Submittal Description
Calculations	• The weighted average of the Energy Efficiency of all the heating units used in the project should be performed on the ARZ.
Manufacturer Datasheets	• The Manufacturer Datasheets should include all the heating units used in the project and should specify their Energy Efficiency values.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.3.2.7 Score Allocation

The score for this criterion is determined based on the Heating Equipment Efficiency requirement. Note that the Design Efficiency value of one of the heating equipment types should achieve at least the Target Efficiency value in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \left[\frac{(H_1 \times S_1) + (H_2 \times S_2) + (H_3 \times S_3)}{H_1 + H_2 + H_3}\right]$$

Where:

$\boldsymbol{H_1}$ **:** Gas and Oil-fired Boilers’ total heating capacity (kW)
$\boldsymbol{H_2}$ **:** Gas-fired Warm-air Furnaces’ total heating capacity (kW)
$\boldsymbol{H_3}$ **:** Gas-fired Warm-air Heaters’ total heating capacity (kW)

As determined in the tables hereunder,

$\boldsymbol{S_1}$ **:** Gas and Oil-fired Boilers’ efficiency score
$\boldsymbol{S_2}$ **:** Gas-fired Warm-air Furnaces’ efficiency score
$\boldsymbol{S_3}$ **:** Gas-fired Warm-air Heaters’ efficiency score

If all the heating equipment has a designed efficiency less than the targeted efficiency, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the heating equipment has a designed efficiency equal to 100%.

Gas and Oil-Fired Boilers Efficiency Score Calculation "$\boldsymbol{S_1}$"

$\boldsymbol{S_1}$ = Weighted average score of all Gas and Oil-fired Boilers

$$\boldsymbol{S_1} = \left[\frac{\sum_{i=1}^{n}(A_i \times B_i)}{\sum_{i=1}^{n}(A_i)}\right]$$

Where:

$\boldsymbol{A_i}$ = Number of installed Gas and Oil-fired Boilers

$\boldsymbol{B_i}$ = Each Gas and Oil-fired Boiler efficiency score as determined in the table below

Table 11.3.2-3. Score "Bi" for the Gas and Oil-fired Boilers' Efficiency Requirement

Gas and Oil-fired Boilers' Efficiency Requirement	**Score " $\boldsymbol{B_i}$ "**
$EF_{GOB\,(Design)} < EF_{GOB\,(Target)}$	0%
$EF_{GOB\,(Design)} = EF_{GOB\,(Target)}$	60%
$EF_{GOB\,(Target)} \leq EF_{GOB\,(Design)} \leq 100\%$	$60\% \leq \boldsymbol{B_i} \leq 100\%$

Where:

$EF_{GOB\,(Design)}$= Each Gas and Oil-fired Boiler designed heating efficiency

$EF_{GOB\,(Target)}$= Each Gas and Oil-fired Boiler targeted heating efficiency

Gas-fired Warm-air Furnaces' Efficiency Score Calculation "$\boldsymbol{S_2}$"

$\boldsymbol{S_2}$ = Weighted average score of all Gas-fired Warm-air Furnaces

$$\boldsymbol{S_2} = \left[\frac{\sum_{i=1}^{n}(C_i \times D_i)}{\sum_{i=1}^{n}(C_i)}\right]$$

Where:

$\boldsymbol{C_i}$ = Number of installed Gas-fired Warm-air Furnaces

$\boldsymbol{D_i}$ = Gas-fired Warm-air Furnace efficiency score as determined in the table hereunder

Table 11.3.2-4. Score "Di" for the Gas-Fired Warm-Air Furnaces' Efficiency Requirement

Gas-Fired Warm-air Furnaces' Efficiency Requirement	**Score " $\boldsymbol{D_i}$ "**
$EF_{WFG\,(Design)} < EF_{WFG\,(Target)}$	0%
$EF_{WFG\,(Design)} = EF_{WFG\,(Target)}$	60%
$EF_{WFG\,(Target)} \leq EF_{WFG\,(Design)} \leq 100\%$	$60\% \leq \boldsymbol{D_i} \leq 100\%$

Where:

$EF_{WFG\,(Design)}$= Designed heating efficiency of each Gas-fired Warm-air Furnace

$EF_{WFG\,(Target)}$= Targeted heating efficiency of each Gas-fired Warm-air Furnace

Gas-fired Warm-air Heaters' Efficiency Score Calculation "$\boldsymbol{S_3}$"

$\boldsymbol{S_3}$ = Weighted average score of all Gas-fired Warm-air Heaters

$$\boldsymbol{S_3} = \left[\frac{\sum_{i=1}^{n}(E_i \times F_i)}{\sum_{i=1}^{n}(E_i)}\right]$$

Where:

$\boldsymbol{E_i}$ = Number of installed Gas-fired Warm-air Heaters

$\boldsymbol{F_i}$ = Efficiency score of each Gas-fired Warm-air Heater as determined in the table hereunder

Table 11.3.2-5. Score "Fi" for the Gas-fired Warm-air Heaters' Efficiency Requirement

Gas-fired Warm-air Heaters' Efficiency Requirement	Score " $\boldsymbol{F_i}$ "
$EF_{WHG\,(Design)} < EF_{WHG\,(Target)}$	0%
$EF_{WHG\,(Design)} = EF_{WHG\,(Target)}$	60%
$EF_{WHG\,(Target)} \leq EF_{WHG\,(Design)} \leq 100\%$	60% ≤ $\boldsymbol{F_i}$ ≤ 100%

Where:

$EF_{WHG\,(Design)}$ = Designed heating efficiency of each Gas-fired Warm-air Heater

$EF_{WHG\,(Target)}$ = Targeted heating efficiency of each Gas-fired Warm-air Heater

11.3.3En-3.3: Refrigeration Equipment Efficiency

11.3.3.1 Criterion Reference and Title

En-3.3: Refrigeration Equipment Efficiency

11.3.3.2 Criterion Type

Optional

11.3.3.3 Intent

To support an effective refrigeration design, and to select and install an efficient refrigeration system so that maximum cooling is achieved with minimum energy consumption.

11.3.3.4 General Requirements

A proper and effective refrigeration design must be complemented with an efficient refrigeration system. This refrigeration system must be carefully selected and installed without any undersizing or oversizing to achieve ultimate cooling with minimum energy consumption. The refrigeration system type mentioned in this criterion will cover the following:

- Commercial refrigerators and freezers
- Commercial refrigeration systems.

All refrigeration systems must comply with the maximum required energy use limits (kWh/day) mentioned and listed in the ASHRAE std. 90-1-2019 reference table hereunder. A Lower value of energy use limit is recommended. It depends on the volume “V” (m^3) or the total display area “TDA” (m^2) of the refrigeration system.

Table 11.3.3-1. The Energy Use Limits Reference Table in ASRHAE std. the 90.1-2019 for Each Refrigeration System Type

Refrigeration System Type	Energy Use Limits Reference Table (ASHRAE std. 90.1-2019)
Commercial Refrigerators and Freezers	Table G3.10.1
Commercial Refrigeration	Table G3.10.2

11.3.3.5 Special Requirements

None

11.3.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.3.3-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Refrigeration Drawings should show the location of all the refrigeration units.
Calculations	• The weighted average of the energy efficiency of all the refrigeration units designed in the project should be performed on the ARZ.
Specifications	• The Specifications of each refrigeration unit designed in the project should indicate the energy use limit values per unit.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Refrigeration Drawings should show the location of all the refrigeration units.
Calculations	• The weighted average of the energy efficiency of all the refrigeration units used in the project should be performed on the ARZ.
Manufacturer Datasheets	• The Manufacturer Datasheets of each refrigeration unit designed in the project should specify the energy use limit values per unit.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Refrigeration Drawings should show the location of all the refrigeration units.
Calculations	• The weighted average of the energy efficiency of all the refrigeration units used in the project should be performed on the ARZ.
Manufacturer Datasheets	• The Manufacturer Datasheets of all the refrigeration units used in the project should specify the energy use limit values.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.3.3.7 Score Allocation

The score for this criterion is determined based on the Refrigeration Equipment Efficiency requirements. Note that at least one efficient refrigeration system should be used in the project in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \left[\frac{\sum_{i=1}^{n}(A_i \times B_i)}{\sum_{i=1}^{n}(A_i)}\right]$$

As determined in the tables hereunder,

Where:

$\boldsymbol{A_i}$ **:** Capacity Factor of each refrigeration unit

$\boldsymbol{B_i}$ **:** Efficiency Score of each refrigeration unit

Table 11.3.3-3. Capacity Factor "Ai" of Each Refrigeration Unit

Capacity Factor of Each Refrigeration Unit	Capacity Factor “ A_i ”
$EU_{(Design)} > EU_{(Target)}$	0
$EU_{(Design)} \leq EU_{(Target)}$	Capacity of the Refrigeration Unit

Table 11.3.3-4. Score for Efficiency "Bi" of Each Refrigeration Unit

Score for Efficiency of Each Refrigeration Unit	Score “ B_i ”
$EU_{(Design)} > EU_{(Target)}$	0%
$EU_{(Design)} = EU_{(Target)}$	60%
$EU_{(Target)} \geq EU_{(Design)} \geq \frac{2}{3} \times EU_{(Target)}$	60% ≤ $\boldsymbol{B_i}$ ≤ 100%

Where:

$EU_{(Design)}$ = The weighted average of the designed maximum energy use limit for the refrigeration system

$EU_{(Target)}$ = The weighted average of the targeted maximum energy use limit for the refrigeration system

$Capacity$ = The capacity of each refrigeration unit calculated by the volume “V” (m^3) or the total display area “TDA” (m^2)

If all the refrigeration systems used are non-efficient, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the refrigeration systems used are efficient types and their designed energy use limits are equal to or less than two-thirds of the targeted energy use limits.

11.3.4En-3.4: Heat Recovery Technologies

11.3.4.1 Criterion Reference and Title

En-3.4: Heat Recovery Technologies

11.3.4.2 Criterion Type

Optional

11.3.4.3 Intent

To support an effective design, and to select and install an efficient heat recovery system which would harvest the energy collected from the wasted heat or air, whether rejected or exhausted to the outside. This harvesting process will significantly save energy and reduce operating costs.

11.3.4.4 General Requirements

Heat recovery refers to the process of reclaiming a portion of the energy wasted by the use of Heating, Ventilation, and Air Conditioning (HVAC) systems or power generators. Heat recovery can be described as a device, which operates between two air sources at different temperatures, and which transfers energy from one side to another.

A) Heat Recovery for Power Generator

Demonstrate that a heat recovery device of an adequate size is designed and installed to recover heat from power generators.

The most common types of heat recovery systems and equipment used for power generators include a shell, a tube and a double-pipe.

B) Heat Recovery for Ventilation System (HVAC)

Demonstrate that a heat recovery device of an adequate size is designed and installed in a ventilation system to recover energy from the wasted exhaust air.

The most common types of heat recovery systems and equipment used for ventilation systems include fixed-plate heat exchangers, rotary wheel heat exchangers, run-around loops and heat pipes.

C) Heat Recovery for Other Systems

Demonstrate that a heat recovery device of an adequate size is designed and installed.

D) Minimum Heat Recovery Efficiency

The minimum heat recovery efficiency shall be as per the table hereunder.

Table 11.3.4-1. Heat Recovery Efficiency of Heat Exchanger Type for Generators

Heat Exchanger Type for Generators	Heat Recovery Efficiency
Shell and Tube	70 %
Double-pipe	60 %

Table 11.3.4-2. Heat Recovery Efficiency of Heat Exchanger Type for Ventilation Systems

Heat Exchanger Type for Ventilation	Heat Recovery Efficiency
Thermal Wheel (Latent and Sensible)	70 %
Thermal Wheel (Sensible Only)	60 %
Heat Pipes	65 %
Plate Heat Exchanger	55 %
Run Around Coil	50 %

Table 11.3.4-3. Heat recovery Efficiency of Heat Exchanger Type for Other Systems

Heat Exchanger Type for Other systems	Heat Recovery Efficiency
Specific Heat Exchanger	50 %

The temperature transfer efficiency for a heat recovery unit can be calculated as

$$\mathbf{\mu}_t = (\mathrm{T}_2 - \mathrm{T}_1) \,/\, (\mathrm{T}_3 - \mathrm{T}_1)$$

Where:

$\mathbf{\mu}_t$ = Temperature transfer efficiency (%)
T_1 = Outdoor make-up air temperature inlet (°C)
T_2 = Supply Air temperature outlet (°C)
T_3 = Exhaust air temperature inlet (°C)

11.3.4.5 Special Requirements

None

11.3.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.3.4-4. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Drawings should show the location of all the heat recovery systems.
Calculations	• The weighted average of the energy efficiency of all the heat recovery units, which are designed in the project, should be performed on the ARZ.
Specifications	• The Specifications of all the heat recovery units designed in the project should specify the units ’energy efficiency values.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Drawings should show all the heat recovery systems.
Calculations	• The weighted average of the energy efficiency of all the heat recovery units, which are used in the project, should be performed on the ARZ.
Manufacturer Datasheets	• The Manufacturer Datasheets of all the heat recovery units used in the project should specify the units’ energy efficiency values.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built drawings should show all the heat recovery systems.
Calculations	• The weighted average of the energy efficiency of all the heat recovery units, which are used in the project, should be performed on the ARZ.

Submittal Name	Submittal Description
Manufacturer Datasheets	• The Manufacturer Datasheets of all the heat recovery units used in the project should specify the units' energy efficiency values.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.3.4.7 Score Allocation

The score for this criterion is determined based on the design weighted average efficiency of the heat recovery system requirements. Note that the heat recovery system for generators, ventilation systems and other systems should be installed in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(F_1 + F_2 + F_3)}{3}\right]$$

Where:

- F_1 = Design weighted average efficiency % of generators
- F_2 = Design weighted average efficiency % of ventilation system
- F_3 = Design weighted average efficiency % of other system

If the project does not include any efficient heat recovery system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all its heat recovery systems are 100% efficient.

11.3.5En-3.5: Efficient Air Distribution

11.3.5.1 Criterion Reference and Title

En-3.5: Efficient Air Distribution

11.3.5.2 Criterion Type

Optional

11.3.5.3 Intent

To support an effective design, and to select and install Efficient Air Distribution, which (1) saves energy significantly, (2) reduces operating and maintenance costs and (3) prolongs the life of the equipment and the reliability of the system.

11.3.5.4 General Requirements

A) Fan Power Performance

Fan Power Performance for HVAC system must comply with the table hereunder.

Table 11.3.5-1. Maximum Specific Fan Power (SFP) and Pressure Drop

System Type	Specific Fan Power (SFP) (W/l/s)		Maximum Pressure Drop
	New Building	Existing Building	(Pa)
Central Mechanical Ventilation Including Heating or Cooling Only	1.5	1.8	400 supply 250 extract
Central Mechanical Ventilation Including Heating and Cooling	1.6	2.2	400 supply 250 extract
Central Mechanical Ventilation with Heating, Cooling and Heat Recovery	1.9	2.5	400 supply 250 extract
Central Mechanical Ventilation with Heating, Cooling and HEPA Filter	2.6	3.2	650 supply 500 extract
All Other Central Mechanical Ventilation Systems	1.1	1.6	400 supply 250 extract
Zonal Extract System (the fan is remote from the zone)	0.5	0.5	200
Zonal Supply System (The fan is remote from the zone, such as ceiling void or roof mounted units)	1.1	1.4	200

Zonal Supply and Extract Ventilation Units (Such as ceiling void or roof units serving a single room or a zone with heat recovery)	1.9	1.9	150
Local Supply and Extract Ventilation Units (Within the local area such as window/wall/roof units, serving one room/area (e.g., Toilet))	0.3	0.4	30
Local Supply and Extract Ventilation Units (Remote from the local area, such as ceiling void or roof mounted units, serving one room/zone with heat recovery)	1.6	1.9	150
Kitchen Extract (The fan is remote from the zone with grease filter)	1.0	1.0	50
All Other Local Ventilation Unit Systems	0.5	0.5	30
Fan Assisted Terminal VAV Unit	1.1	1.1	30
Fan Coil Units (Weighted Average)	0.5	0.5	30

B) High Efficiency Fan Motor

Fans shall be adequately-sized (1) to attain their Best Efficiency Point (BEP) and (2) to achieve maximum efficiency at the lowest running cost, with the least risk of failure and the greatest life expectancy. Fans shall be equipped by highly efficient electric motors. All three-phase motors with a rated output of 15 to 375 kW must meet at least either the IE3 or IE2 energy efficiency level, and must be equipped with a variable speed drive according to the table hereunder. The energy efficiency rating is the ratio of mechanical output power to electrical input power.

Table 11.3.5-2. Minimum Motor Rated Efficiency

Motor Rated Output (kW)	Minimum Rated Efficiency (%)							
	IE2 Motors (High Efficiency)				IE3 Motors (Premium Efficiency)			
	2 pole	4 pole	6 pole	8 pole	2 pole	4 pole	6 pole	8 pole
0.75	77.4	79.6	75.9	66.2	80.7	82.5	78.9	75.0
1.1	79.6	81.4	78.1	70.8	82.7	84.1	81.0	77.7
1.5	81.3	82.8	79.8	74.1	84.2	85.3	82.5	79.7
2.2	83.2	84.3	81.8	77.6	85.9	86.7	84.3	81.9
3	84.6	85.5	83.3	80.0	87.1	87.7	85.6	83.5
4	85.8	86.6	84.6	81.9	88.1	88.6	86.8	84.8
5.5	87.0	87.7	86.0	83.8	89.2	89.6	88.0	86.2
7.5	88.1	88.7	87.2	85.3	90.1	90.4	89.1	87.3
11	89.4	89.8	88.7	86.9	91.2	91.4	90.3	88.6
15	90.3	90.6	89.7	88.0	91.9	92.1	91.2	89.6
18.5	90.9	91.2	90.4	88.6	82.4	92.6	91.7	90.1

22	91.3	91.6	90.9	89.1	92.7	93.0	92.2	90.6
30	92.0	92.3	91.7	89.8	93.3	93.6	92.9	91.3
37	92.5	92.7	92.2	90.3	93.7	93.9	93.3	91.8
45	92.9	93.1	92.7	90.7	94.0	94.2	93.7	92.2
55	93.2	93.5	93.1	91.0	94.3	94.6	94.1	92.5
75	93.8	94.0	93.7	91.6	94.7	95.0	94.6	93.1
90	94.1	94.2	94.0	91.9	95.0	95.2	94.9	93.4
110	94.3	94.5	94.3	92.3	95.2	95.4	95.1	93.7
132	94.6	94.7	94.6	92.6	95.4	95.6	95.4	94.0
160	94.8	94.9	94.8	93.0	95.6	95.8	95.6	94.3
200 - 375	95.0	95.1	95.0	93.5	95.8	96.0	95.8	94.6
Note: Motors with constant speed must meet the IE3 and IE2 efficiency levels for motors with variable-speed drives to secure the CE mark.								

C) Fan Motor Control

In general, HVAC system fans are designed to operate at the peak load, which only happens for a very short while throughout the year. Among the best ways to enhance the building energy efficiency is to utilize either the Variable Speed Drives (VSDs) or the Variable Frequency Drives (VFDs).

Demonstrate that AHU fans, cooling tower fans and commercial kitchen hood fans with motors equal to or greater than 3.7 kW (5 HP), shall be equipped with VFDs to control the speed of the fan motors based on the actual demand and the operation schedules. By adjusting the voltage of the VSD control and the frequency of the VFD control, the energy consumption is significantly reduced, the efficiency and the operation of the systems are optimized, the operating and maintenance costs are reduced, and the life of the equipment and the reliability of the system are prolonged.

Note: This is applicable to all the building sector whenever there is a possibility to achieve energy saving via the implementation of a VFD control. However, this does not apply to healthcare facilities where the continuous function of a mechanical ventilation system is critical especially in specific areas, such as Operation rooms, Isolation rooms, IT rooms, etc.

D) Ductwork Leakage Limit

At least 75% of the ductwork area should be tested for air leakage. This air leakage, if found, should meet the corresponding maximum allowable air leakage limit given in the table hereunder according to the four classes of duct tightness:

Class A – The baseline for use in ventilating units, ventilators, etc.
Class B – The minimum value for ventilation ducts
Class C – The ventilation ducts in high pressure installations

Class D – The installations for special purposes- especially intended for higher energy efficiency and hygiene standards.

Table 11.3.5-3. Air Leakage Limit of Ductwork

Leakage	Static Pressure (Pa)		Air Leakage Limit
Class	**Positive Pressure**	**Negative Pressure**	**(L/s.m^2 of duct area)**
A	500	500	0.027 x $P^{0.65}$
B	1000	750	0.009 x $P^{0.65}$
C	2000	750	0.003 x $P^{0.65}$
D[a]	2000	750	0.001 x $P^{0.65}$

E) Ductwork Insulation

The ductwork shall be properly air-sealed and protected from moisture absorption to preserve its insulating properties or to prevent its degradation. All the insulation installations of the external ductwork shall be provided with a suitable vapor barrier and must be protected from the Ultra Violet (UV) light. The ductwork shall be insulated with the minimum insulation thickness specified as per the table hereunder.

Table 11.3.5-4. Minimum Duct Insulation R-Value

Minimum Duct Insulation R-Value [a] (m^2.K/W)		
Duct Location	**Supply Ducts**	**Return Ducts**
Exterior	R-1.4	R-0.6
Ventilated Attic	R-1.0	R-0.6
Unventilated Attic Above Insulated Ceiling	R-1.0	R-0.6
Unventilated Attic with Roof Insulation	R-0.6	None
Unconditioned Space [b]	R-0.6	None
Indirectly Conditioned Space [c]	None	None
Buried	R-0.6	None

a. Insulation resistance which is measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 24°C at the installed thickness.
b. An unconditioned Space includes crawlspaces, both ventilated and non-ventilated.
c. An indirectly conditioned Space includes return air plenums with or without exposed roofs above.

11.3.5.5 Special Requirements

None

11.3.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.3.5-5. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The HVAC drawings should show the location of all the fans or ventilation units, the control system, and the ducting system.
Specifications	• The Specifications of all the fans or ventilation units, the control system and the ducting system designed in the project should include the following: (1) the maximum Specific Fan Power (SFP), and the maximum pressure drop of all the fans (2) the leakage limit and the resistance value of the ducting system insulation.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built HVAC drawings should show the location of all the fans or the ventilation units, the control system and the ducting system.
Manufacturer Datasheets	• The Manufacturer Datasheets of all the fans or ventilation units, the control system and the duct insulation used in the project should include the following: (1) The maximum Specific Fan Power (SFP), and the maximum pressure drop of all the fans (2) The resistance value of the ducting system insulation.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
As-built Drawings	• The As-built HVAC drawings should show the location of all the fans or ventilation units, the control system, and the ducting system.
Manufacturer Datasheets	• The Manufacturer Datasheets of all the fans or ventilation units, the control system and the duct insulation used in the project should include the following: (1) The maximum Specific Fan Power (SFP), and the maximum pressure drop of all the fans, (2) The resistance value of the ducting system insulation.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.3.5.7 Score Allocation

The score for this criterion is determined based on the Efficient Air Distribution requirements. Note that at least one of the following Efficient Air Distribution requirements shall be performed: (1) fan power performance, (2) duct leakage limit, (3) duct insulation or (4) fan efficiency and control in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{27} F_i)}{(\sum_{i=1}^{27} WF_i)}\right]$$

Table 11.3.5-6. Factors and Weight Factors of Each Criterion Requirement

Criterion Requirement		Status	Factor "F"		Weight Factor "WF"	
Fan Power Performance	**Does the central mechanical ventilation include heating only or cooling only?**	Yes	F_1	$A_1 + B_1$	WF_1	4
		N/A		0		0
	Does the central mechanical ventilation include heating and cooling?	Yes	F_2	$A_2 + 2$	WF_2	4
		N/A		0		0
	Does the central mechanical ventilation include heating, cooling and heat recovery?	Yes	F_3	$A_3 + B_3$	WF_3	4
		N/A		0		0
	Does the central mechanical ventilation include heating, cooling and a HEPA filter?	Yes	F_4	$A_4 + B_4$	WF_4	4
		N/A		0		0

	All Other Central Mechanical Ventilation Systems	Yes	F_5	$A_5 + B_5$	WF_5	4
		N/A		0		0
	A Zonal Extract System (The fan is remote from the zone)	Yes	F_6	$A_6 + B_6$	WF_6	4
		N/A		0		0
	A Zonal Supply System (The fan is remote from the zone)	Yes	F_7	$A_7 + B_7$	WF_7	4
		N/A		0		0
	Zonal Supply and Extract Ventilation Units	Yes	F_8	$A_8 + B_8$	WF_8	4
		N/A		0		0
	Local Supply and Extract Ventilation Units (Within the local area)	Yes	F_9	$A_9 + B_9$	WF_9	4
		N/A		0		0
	Local Supply and Extract Ventilation Units (Remote from the local area)	Yes	F_{10}	$A_{10} + B_{10}$	WF_{10}	4
		N/A		0		0
	Kitchen extract (The fan is remote from the zone with the grease filter)	Yes	F_{11}	$A_{11} + B_{11}$	WF_{11}	4
		N/A		0		0
	All Other Local Ventilation or Extract Unit Systems	Yes	F_{12}	$A_{12} + B_{12}$	WF_{12}	4
		N/A		0		0
	A Fan Assisted Terminal VAV Unit	Yes	F_{13}	$A_{13} + B_{13}$	WF_{13}	4
		N/A		0		0
	Fan Coil Units (weighted average)	Yes	F_{14}	$A_{14} + B_{14}$	WF_{14}	4
		N/A		0		0
Duct Leakage	At least 75% of the ductwork area should be tested for leakage and should meet the maximum allowable air leakage limit.	Yes	F_{15}	1	WF_{15}	1
		No		0		1
		N/A		0		0
Minimum Duct Insulation	Exterior	Yes	F_{15}	1	WF_{15}	1
		No		0		1
		N/A		0		0
	Ventilated Attic	Yes	F_{16}	1	WF_{16}	1
		No		0		1
		N/A		0		0
	Unventilated Attic Above Insulated Ceiling	Yes	F_{17}	1	WF_{17}	1
		No		0		1
		N/A		0		0
	Unventilated Attic with Roof Insulation	Yes	F_{18}	1	WF_{18}	1
		No		0		1
		N/A		0		0
	Unconditioned Space	Yes	F_{19}	1	WF_{19}	1
		No		0		1
		N/A		0		0
	Indirectly Conditioned Space	Yes	F_{20}	1	WF_{20}	1
		No		0		1

			N/A		0		0
	Water Outlet Temperature		Yes	F_{21}	1	WF_{21}	1
			No		0		1
			N/A		0		0
	Buried		Yes	F_{22}	1	F_{22}	1
			No		0		1
			N/A		0		0
Fan Efficiency and Control	**Fan Sizing**		Yes	F_{23}	1	WF_{23}	1
			No		0		1
			N/A		0		0
	Efficient Motor		Yes	F_{24}	2	WF_{24}	2
			No		0		2
			N/A		0		0
	Fan Control	**A VFD Control for AHUs Fan Motors (Equal to or greater than 3.7 KW (5hp))**	Yes	F_{25}	2	WF_{25}	2
			No		0		2
			N/A		0		0
		A VFD Control for Cooling Towers Fan Motors (Equal to or greater than 3.7 KW (5hp))	Yes	F_{26}	2	WF_{26}	2
			No		0		2
			N/A		0		0
		A VFD Control for Commercial Kitchen Hood Fan Motors (Equal to or greater than 3.7 kW (5hp))	Yes	F_{27}	2	WF_{27}	2
			No		0		2
			N/A		0		0

As determined in the tables hereunder,

Where:

A_1 to A_{14} **:** Score of the Specific Fan Power (SFP) Requirement

B_1 to B_{14} **:** Score of the Max Pressure Drop Requirement

Table 11.3.5-7. Score "A1 to A14" for Specific Fan Power (SFP) Efficiency Requirement

Domestic Water Heater Efficiency Requirement	**Score “ A_1 to A_{14}” for Specific Power Factor (Fan Efficiency)**
$SFP_{(Design)} > SFP_{(Target)}$	0
$SFP_{(Design)} \leq SFP_{(Target)}$	3

Table 11.3.5-8. Score "B1 to B14" for Maximum Pressure Drop Requirement of Supply and Exhaust Ducting System

Pool Water Heater Efficiency Requirement	**Score “ B_1 to B_{14}” for Maximum Pressure Drop**
$PD_{(Design)} > PD_{(Target)}$	0

$PD_{(Design)} \leq PD_{(Target)}$	1

Where:
$SFP_{(Design)}$ = Fan designed specific fan power (W/l/s)$SPF_{(Target)}$ = Fan targeted specific fan power (W/l/s)

$PD_{(Design)}$ = Designed maximum pressure drop (Pa)

$PD_{(Target)}$ = Targeted maximum pressure drop (Pa)

If the project does not include any criterion requirements for efficient air distribution, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the criterion requirements for efficient air distribution are met.

11.3.6En-3.6: Efficient Water Distribution

11.3.6.1 Criterion Reference and Title

En-3.6: Efficient Water Distribution

11.3.6.2 Criterion Type

Optional

11.3.6.3 Intent

To support an effective design, and to select and install Efficient Water Distribution, which (1) saves energy significantly, (2) reduces operating and maintenance costs and (3) prolongs the life of the equipment and the reliability of the system.

11.3.6.4 General Requirements

A) Waterpipe Sizing

Water pipes with a diameter larger than 50 mm should be sized for frictional loss which shall not exceed 400 Pa/m, and water flow velocity which shall not exceed 3 m/s. Water pipes with 50 mm in diameter or less should be sized for flow velocity which shall not exceed 1.2 m/s.

B) Pump Sizing and Selection

The selected pump should operate efficiently. It should attain its Best Efficiency Point (BEP), and should achieve its maximum efficiency at the lowest running cost, with the least risk of failure and the greatest life expectancy.

C) Pipework Insulation

The required minimum insulation conductivity and thickness of the piping system pertaining to the heating and cooling systems shall be based on the fluid operating temperature of the system as shown in the table hereunder. The insulation which is exposed to the weather shall be protected by aluminum sheet metals, painted canvas, or plastic covers. Cellular foam insulation shall be protected as previously mentioned, or shall be painted with water retardant paint.

Table 11.3.6-1. Minimum Insulation Conductivity and Thickness for Piping System of Heating and Cooling Systems [a]

HVAC System Type	Fluid Operating Temperature (°C)	Minimum Insulation Conductivity (W/ m.K)	Minimum Insulation Thickness (mm)

Heating System [b] (Hot Water)	60°C < T ≤ 90°C	0.040	50
	40°C < T ≤ 60°C	0.035	40
Cooling System (Chilled Water, Brine, Refrigerant)	4°C < T ≤ 16°C	0.035	25
	T ≤ 4°C	0.030	25

a. These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.
b. For direct-buried cooling system piping, insulation is not required.

High Efficiency Pump Motor

All motors with a rated output of 0.75 to 375 kW shall meet at least the IE3 energy efficiency level (Premium Efficiency) or the IE2 energy efficiency level (High Efficiency), and be equipped with a variable speed drive according to the table hereunder. The energy efficiency rating is the ratio of mechanical output power to electrical input power.

Table 11.3.6-2. Minimum Rated Efficiency

Motor Rated Output (kW)	**Minimum Rated Efficiency (%)**							
	IE2 Motors (High Efficiency)				**IE3 Motors (Premium Efficiency)**			
	2 pole	**4 pole**	**6 pole**	**8 pole**	**2 pole**	**4 pole**	**6 pole**	**8 pole**
0.75	77.4	79.6	75.9	66.2	80.7	82.5	78.9	75.0
1.1	79.6	81.4	78.1	70.8	82.7	84.1	81.0	77.7
1.5	81.3	82.8	79.8	74.1	84.2	85.3	82.5	79.7
2.2	83.2	84.3	81.8	77.6	85.9	86.7	84.3	81.9
3	84.6	85.5	83.3	80.0	87.1	87.7	85.6	83.5
4	85.8	86.6	84.6	81.9	88.1	88.6	86.8	84.8
5.5	87.0	87.7	86.0	83.8	89.2	89.6	88.0	86.2
7.5	88.1	88.7	87.2	85.3	90.1	90.4	89.1	87.3
11	89.4	89.8	88.7	86.9	91.2	91.4	90.3	88.6
15	90.3	90.6	89.7	88.0	91.9	92.1	91.2	89.6
18.5	90.9	91.2	90.4	88.6	82.4	92.6	91.7	90.1
22	91.3	91.6	90.9	89.1	92.7	93.0	92.2	90.6
30	92.0	92.3	91.7	89.8	93.3	93.6	92.9	91.3
37	92.5	92.7	92.2	90.3	93.7	93.9	93.3	91.8
45	92.9	93.1	92.7	90.7	94.0	94.2	93.7	92.2
55	93.2	93.5	93.1	91.0	94.3	94.6	94.1	92.5
75	93.8	94.0	93.7	91.6	94.7	95.0	94.6	93.1
90	94.1	94.2	94.0	91.9	95.0	95.2	94.9	93.4
110	94.3	94.5	94.3	92.3	95.2	95.4	95.1	93.7
132	94.6	94.7	94.6	92.6	95.4	95.6	95.4	94.0
160	94.8	94.9	94.8	93.0	95.6	95.8	95.6	94.3
200 - 375	95.0	95.1	95.0	93.5	95.8	96.0	95.8	94.6
Note: Motors with constant speed must meet the IE2 and IE3 efficiency levels for motors with variable-speed drives to secure the CE mark.								

In general, HVAC system pumps are designed to operate at the peak load, which only happens for a very short while throughout the year. Among the best ways to enhance the building energy efficiency is to utilize either the Variable Speed Drives (VSDs) or the Variable Frequency Drives (VFDs).
Demonstrate that all chilled water or condenser water systems, which have pump motors equal to or greater than 3.7 kW (5 hp), shall be controlled either by Variable Speed Drives (VSDs) or by Variable Frequency Drives (VFDs). By adjusting the voltage of the VSD control and the frequency the VFD control, the energy consumption is significantly reduced, the efficiency and the operation of the systems are optimized, the operating and maintenance costs are reduced, and the life of the equipment and the reliability of the system are prolonged.

Note: This is applicable to all the building sector whenever there is a possibility to achieve energy saving via the implementation of a VFD control. However, this does not apply to healthcare facilities where the continuous function of a pumping system for a cooling system is critical especially in specific areas, such as Operation rooms, Isolation rooms, IT rooms, etc.

11.3.6.5 Special Requirements

None

11.3.6.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.3.6-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The HVAC Design Drawings should (1) show the location of the efficient water pumps and (2) include the schedule, the control system type, and the waterpipes' insulation and size.
Specifications	• The Specifications of the following should be provided: ○ All the water pumps' efficiency ○ All the water pumps' control system

Submittal Name	Submittal Description
	○ The insulation of the water piping system.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built HVAC Drawings should (1) show the location of the efficient water pumps and (2) include the schedule, the control system type, and the waterpipes' insulation and size.
Manufacturer Datasheets	• The Manufacturer Datasheets of all of the following should be provided: ○ All the water pumps' efficiency ○ All the water pumps' control system ○ The insulation of the water piping system.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built HVAC Drawings should (1) show the location of the efficient water pumps, and (2) include the schedule, the control system type, and the waterpipes' insulation and size.
Manufacturer Datasheets	• The Manufacturer Datasheets of all of the following should be provided: ○ All the water pumps' efficiency ○ All the water pumps' control system ○ The insulation of the water piping system.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.3.6.7 Score Allocation

The score for this criterion is determined based on the Efficient Water Distribution requirements. Note that in order to qualify for this criterion, at least one of the efficient water distribution requirements such as pipe sizing and insulation, or pump efficiency and control, should be performed. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{9} F_i * WF_i)}{(\sum_{i=1}^{9} WF_i)}\right]$$

Table 11.3.6-4. Factors and Weight Factors of Each Criterion Requirement

Criterion Requirement			Status	Factor "F"		Weight Factor "WF"	
Pipe Insulation and Sizing	**Pipe Sizing**		Yes	F_1	1	WF_1	1
			No		0		1
			N/A		0		0
	Heating System	60°C < T ≤ 90°C	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
		40°C < T ≤ 60°C	Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
	Cooling System	4°C < T ≤ 16°C	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
		T ≤ 4°C	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
	Insulation protection		Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
Pump Efficiency and Control	**Pump Sizing**		Yes	F_7	1	WF_7	1
			No		0		1
			N/A		0		0
	Efficient Motor		Yes	F_8	1	WF_8	3
			No		0		3
			N/A		0		0
	Pump Control		Yes	F_9	1	WF_9	2
			No		0		2
			N/A		0		0

The score for this criterion will be 0% if the project does not include any criterion requirement for pipe sizing and insulation, and pump efficiency and control. A project earns a score of 100% for this criterion if all the criterion requirements are met.

11.3.7En-3.7: Efficient Ventilation System

11.3.7.1 Criterion Reference and Title

En-3.7: Efficient Ventilation System

11.3.7.2 Criterion Type

Optional

11.3.7.3 Intent

To support an effective design, and to select and install an Efficient Ventilation System, which (1) saves energy significantly, (2) reduces operating and maintenance costs and (3) enhances the well-being and comfort of building occupants.

11.3.7.4 General Requirements

1) Natural Ventilation

a. Natural Ventilation Strategies

Demonstrate that natural ventilation is an effective strategy and that it complies with the flow diagram in figure 2.8 of CIBSE AM10- 2005 (Option-1), or meets the requirements in section 6.4 of the ASHRAE Std. 62.1–2019 (Option-2).

The size and location of the openings shall be sized and calculated in accordance with CIBSE AM10- 2005 (Option-1) or shall meet the requirements in section 6.4.1.6.1 of ASHRAE Std. 62.1–2019 (Option-2).

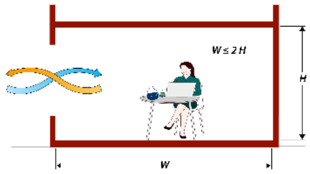
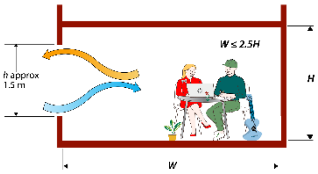
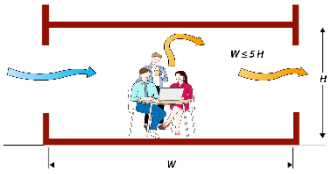
The “Room Depth to Ceiling Height Ratio” for all ventilated spaces in the building must be calculated as per the table hereunder.

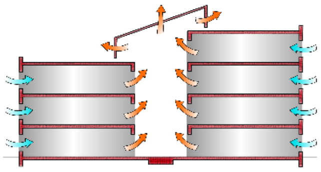
An additional score can be rewarded if a Computational Fluid Dynamics (CFD) analysis of natural ventilation is provided to analyze the best airflow configuration while respecting the thermal comfort requirements mentioned in WE-4.1 Computational Fluid Dynamics (CFD) criterion.

b. CO_2 Monitoring System

Locate CO_2 sensors between 0.9 meters and 1.8 meters above the floor in the breathing zone in each natural ventilation zone. These $_{CO2}$ sensors shall be audible and equipped with a visual alarm in order to indicate that ventilation adjustments are required by automatic indication devices on all natural ventilation openings in the affected space. What is considered an affected space is where the CO_2 concentration is greater than 500 ppm (parts per million) above outdoor CO2 levels or exceeds 1,000 ppm (parts per million) absolute to ensure that natural ventilation maintains minimum outdoor airflow rates under all operating conditions.

Table 11.3.7-1. Natural Ventilation Strategies and Maximum Depth of Floor to Ceiling Height Ratio

Type	Case	Maximum Depth of Floor to Ceiling Height Ratio	Description
Single-sided ventilation, single opening		2.0	A single-sided ventilation with a single opening in the ventilated space. The wind turbulence is the main driving force for natural ventilation.
Single-sided ventilation, double opening		2.5	A single-sided ventilation with a double opening each located at a different height in the ventilated space. The natural ventilation which is the main driving force has a stack effect.
Cross ventilation single-banked space		5.0	A cross ventilation in a single-banked space relies on openings on both sides of the ventilated space. The main driving force for natural ventilation is the wind which is driven by a differential pressure between the windward and leeward sides.
Cross ventilation double-banked spaces		5.0	The cross-ventilation in a double-banked space relies on an opening in the corridor partition between the rooms. The main driving force for natural ventilation is the wind which is driven by a differential pressure between the windward and leeward sides.

Stack Ventilation		-	Stack ventilation draws air across the ventilated space and then exhausts the air through a vertical flow path like a chimney or atrium. The main driving force for natural ventilation is the wind which is driven by density differences.

2) Mechanical Ventilation

a. Minimum Ventilation Rate

For mechanically ventilated buildings, the minimum ventilation rate should be determined in accordance with the procedures described in the ASHRAE Std. 62.1-2019 (All building sectors) and the ASHRAE Std. 170-2017 (Hospitals only).

b. CO_2 Monitoring System

Install permanent CO_2 sensors with a CO_2 monitoring control system in the main areas. At least 70% of the building should be covered to ensure the minimum outdoor airflow rates at all times. The CO_2 concentration must neither be greater than 500 ppm (parts per million) above the outdoor CO_2 levels nor exceed 1,000 ppm absolute to maintain the minimum outdoor airflow rates under all operating conditions.

For a ducted HVAC system, at least one CO_2 sensor must be installed at each return point. For a ductless HVAC system, CO_2 sensors must be installed in the breathing zone of each mechanical ventilation zone between 0.9 meters and 1.8 meters above the floor level.

c. Demand-Controlled Ventilation (DCV) System

Install a Demand-Controlled Ventilation system (DCV) for each mechanical ventilation system serving spaces larger than 50 m^2, in densely-occupied spaces which exceed 4 m^2/person of floor area, and are served by systems with one or more of the following:

- Air economizer
- Automatic modulating control of outdoor air damper
- Design outdoor airflow greater than 1400 L/s.

The Demand-Controlled Ventilation (DCV) system must have CO_2 sensors, which measure the CO_2 concentration and control the airflow of the ventilation system in order to achieve at least the required minimum outdoor airflow rates required by ASHRAE std. 62.1-2019, and ASHRAE Std. 170-2017. This will save energy and create a healthy indoor environment.

d. Economizer

An air economizer must be installed in the HVAC system to reduce the air conditioning costs by using outside air for free cooling causing the compressor to run less.

3) Mixed Mode Ventilation

The Mixed Mode Ventilation incorporates natural ventilation with traditional mechanical ventilation systems, all while reducing energy consumption, providing a healthier indoor climate, and reducing CO_2 emissions. Therefore, the same requirements mentioned earlier must be met for both natural ventilation and mechanical ventilation.

Demonstrate that the Mixed Mode Ventilation is an effective strategy, which complies with the flow diagram in Section 2.1 of CIBSE AM13- 2000. Identify which mixed-mode strategy applies to the project.

11.3.7.5 Special Requirements

For the Hospital Building Sector

For mechanically ventilated and mixed-mode spaces, when the mechanical ventilation is active, the ventilated spaces must meet the minimum requirements found in the ASHRAE Std. 170-2017. In any space type which is not covered by this standard, the ASHRAE Std. 62.1-2019 should be used instead the ASHRAE Std. 170-2017.

11.3.7.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.3.7-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Architectural Drawings should show the location and the size of the ventilation openings, their dimensions, the height and the area of each ventilated space. The sections should show the floor to ceiling height for every floor. • The MEP Drawings should show the location of the CO_2 monitoring system with the sensors including the mounting

Submittal Name	Submittal Description
	height, the Demand Controlled Ventilation (DCV) system and the economizer, if used.
Specifications	• The Specifications of the natural/mechanical or mixed mode ventilation system strategies should not only describe the CO_2 monitoring system with the sensors, but should also include details about the mounting height, the Demand Controlled Ventilation (DCV) system and the economizer, if used.
Calculations	• The Calculations which should be performed are ○ Natural/Mechanical or mixed mode ventilation calculations ○ Room depth to ceiling height ratio calculations and the minimum area of opening, such as windows or skylights, for each space if the natural ventilation strategy is used.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Architectural Drawings should show the location and the size of ventilation openings, their dimensions, the height and the area of each ventilated space. The sections should show the floor to ceiling height for every floor. • The As-built MEP Drawings should show the location of the CO_2 monitoring system with the sensors including the mounting height, the Demand Controlled Ventilation (DCV) system and the economizer if used.
Manufacturer Datasheets	• The Manufacturer Datasheets of the natural/mechanical or mixed mode ventilation system strategies should not only describe the CO_2 monitoring system with the sensors, but should also include details about the mounting height, the Demand Controlled Ventilation (DCV) system and the economizer, if used.
Calculations	• The updated calculations (if different from the Design Phase)
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Architectural Drawings should show the location and the size of ventilation openings, their dimensions, the

Submittal Name	Submittal Description
	height and the area of each ventilated space. The sections should show the floor to ceiling height for every floor. • The As-built MEP Drawings should show the location of the CO_2 monitoring system with the sensors including the mounting height, the Demand Controlled Ventilation (DCV) system and the economizer, if used.
Manufacturer Datasheets	• The Manufacturer Datasheets of the natural/mechanical or mixed mode ventilation system strategies should not only describe the CO_2 monitoring system with the sensors, but should also include details about the mounting height, the Demand Control Ventilation system (DCV) and the economizer, if used.
Calculations	• The Calculations which should be performed are ○ Natural/Mechanical or mixed mode ventilation calculations. ○ Room depth to ceiling height ratio calculations and the minimum area of opening, such as windows or skylights, for each space if the natural ventilation strategy is used.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.3.7.7 Score Allocation

The score for this criterion is determined based on the Efficient Ventilation System requirements. Note that the Efficient Ventilation System requirements. Natural ventilation and/or mechanical ventilation should be at least performed in order to qualify for this criterion.

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{12} F_i * WF_i)}{(\sum_{i=1}^{12} WF_i)}\right]$$

Table 11.3.7-3. Factors and Weight Factors of Each Criterion Requirement

Criterion requirements			Status	Factor "F"		Weight Factor "WF"	
Natural Ventilation	**Effective Strategy**	To demonstrate which natural ventilation is complying to CIBSE or ASHRAE Standard.	Yes	F_1	1	WF_1	1
			No		0		1
	Opening Size and Location	Opening size and location in accordance with CIBSE AM10-2005 or ASHRAE 62.1–2019	Yes	F_2	1	WF_2	2
			No		0		2
	Room depth to ceiling height ratio	The "Room depth to ceiling height ratio" for ventilated spaces must be calculated.	Yes	F_3	1	WF_3	3
			No		0		3
	CO_2 Monitoring System	Installation of CO_2 sensors with CO_2 monitoring control system	Yes	F	1	WF_4	2
			No		0		2
		Control requirement of CO_2 monitoring system according to CO_2 concentration	Yes	F_5	1	WF_5	1
			No		0		1
Mechanical Ventilation	**Minimum Ventilation Rate**	Minimum ventilation rate should be determined in accordance with ASHRAE.	Yes	F_6	1	WF_6	1
			No		0		1
	CO_2 Monitoring System	Installation of CO_2 sensors with monitoring control system in the main areas and covering at least 70% of the building	Yes	F_7	1	WF_7	2
			No		0		2
			N/A		0		0
		The CO_2 concentration must not be greater than 500 ppm above outdoor CO_2 levels or exceed 1,000 ppm absolute.	Yes	F_8	1	WF_8	1
			No		0		1
			N/A		0		0
		Installation requirement of CO_2 sensors for ducted and ductless HVAC system	Yes	F_9	1	WF_9	1
			No		0		1
			N/A		0		0
	Demand Controlled Ventilation system	Installation of Demand Controlled Ventilation system for spaces > 50 m^2 with densely occupied spaces exceeding 0.25 person / m^2	Yes	F_{10}	1	WF_{10}	3
			No		0		3
			N/A		0		0

		Installation and control requirement of CO_2 sensors according to minimum outdoor airflow rates of ASHRAE std. 90.1-2019.	Yes	$\boldsymbol{F_{11}}$	1	$\boldsymbol{WF_{11}}$	2
			No		0		2
			N/A		0		0
	Economizer	Monitoring of space temperature and humidity adjustment	Yes	$\boldsymbol{F_{12}}$	1	$\boldsymbol{WF_{12}}$	2
			No		0		2
			N/A		0		0

If the project does not include any criterion requirement for natural ventilation or mechanical ventilation, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the criterion requirements are met.

11.4 Family: Domestic Water Systems

11.4.1En-4.1: Efficient Domestic Water Distribution

11.4.1.1 Criterion Reference and Title

En-4.1: Efficient Domestic Water Distribution

11.4.1.2 Criterion Type

Optional

11.4.1.3 Intent

To support an effective design, and to select and install Efficient Domestic Water Distribution, which (1) saves energy significantly, (2) reduces operating and maintenance costs, and (3) prolongs the life of the equipment and the reliability of the system.

11.4.1.4 General Requirements

A) Pump Sizing and Selection

Select an efficient pump which operates close to its Best Efficiency Point (BEP) as much as possible to achieve maximum efficiency at the lowest running cost with a minimum risk of failure and the greatest life expectancy.

B) Variable Frequency Drive "VFD"

In general, pumps for domestic water systems are designed to operate at constant speed. One of the most effective ways to improve building energy efficiency is to utilize the Variable Speed Drives (VSDs) or Variable Frequency Drives (VFDs) for pumps.

Demonstrate that all water supply systems which have pump motors greater than or equal to 3.7 KW (5 hp) shall be controlled either by Variable Speed Drives (VSDs) or by Variable Frequency Drives (VFDs). Both drives control the speed of the pump motor based on actual demand by changing either the frequency for the VFD control or the voltage for the VSD control. Utilizing these drives (1) saves energy significantly, (2) reduces operating and maintenance costs and (3) prolongs the life of the equipment and the reliability of the system.

This is applicable to all building types except for some rooms in healthcare facilities due to the critical function of the water pumping system in special areas.

C) High Efficiency Motors

All motors with a rated output of 0.75 to 375 kW must meet at least either the IE3 energy efficiency level, or the IE2 energy efficiency level, and must be equipped with a Variable Speed Drive as per the table hereunder. The Energy Efficiency rating is the ratio of the mechanical output power to the electrical input power.

Table 11.4.1-1. Minimum Motor Rated Efficiency

Motor Rated Output (kW)	Minimum Rated Efficiency (%)							
	IE2 Motors (High Efficiency)				IE3 Motors (Premium Efficiency)			
	2 poles	4 poles	6 poles	8 poles	2 poles	4 poles	6 poles	8 poles
0.75	77.4	79.6	75.9	66.2	80.7	82.5	78.9	75.0
1.1	79.6	81.4	78.1	70.8	82.7	84.1	81.0	77.7
1.5	81.3	82.8	79.8	74.1	84.2	85.3	82.5	79.7
2.2	83.2	84.3	81.8	77.6	85.9	86.7	84.3	81.9
3	84.6	85.5	83.3	80.0	87.1	87.7	85.6	83.5
4	85.8	86.6	84.6	81.9	88.1	88.6	86.8	84.8
5.5	87.0	87.7	86.0	83.8	89.2	89.6	88.0	86.2
7.5	88.1	88.7	87.2	85.3	90.1	90.4	89.1	87.3
11	89.4	89.8	88.7	86.9	91.2	91.4	90.3	88.6
15	90.3	90.6	89.7	88.0	91.9	92.1	91.2	89.6
18.5	90.9	91.2	90.4	88.6	82.4	92.6	91.7	90.1
22	91.3	91.6	90.9	89.1	92.7	93.0	92.2	90.6
30	92.0	92.3	91.7	89.8	93.3	93.6	92.9	91.3
37	92.5	92.7	92.2	90.3	93.7	93.9	93.3	91.8
45	92.9	93.1	92.7	90.7	94.0	94.2	93.7	92.2
55	93.2	93.5	93.1	91.0	94.3	94.6	94.1	92.5
75	93.8	94.0	93.7	91.6	94.7	95.0	94.6	93.1
90	94.1	94.2	94.0	91.9	95.0	95.2	94.9	93.4
110	94.3	94.5	94.3	92.3	95.2	95.4	95.1	93.7
132	94.6	94.7	94.6	92.6	95.4	95.6	95.4	94.0
160	94.8	94.9	94.8	93.0	95.6	95.8	95.6	94.3
200 - 375	95.0	95.1	95.0	93.5	95.8	96.0	95.8	94.6
Note: Motors with constant speed must meet the IE3 efficiency levels as well as the IE2 efficiency levels for motors with variable-speed drives to secure the CE mark.								

D) Pipework Insulation

The required R-values of insulation for domestic hot water systems shall be based on the operating temperature of the system as shown in the table hereunder. The insulation which is exposed to the weather shall be protected by either aluminum sheet metals, painted canvas, or plastic covers. The cellular foam insulation shall be protected as mentioned earlier, or shall be painted with water retardant paint.

Table 11.4.1-2. Insulation with Minimum R-value ($m^2.K/W$)

System Type	Fluid operating Temperature (°C)	Minimum Insulation Conductivity (W/ m.K)	Minimum Insulation Thickness (mm)
Domestic Hot Water	60°C < T ≤ 90°C	0.040	50
	40°C < T ≤ 60°C	0.035	40

a. These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

b. For direct-buried cooling system piping, insulation is not required.

E) Frictional Loss and Pressure Drop of Water Piping System

Water pipes with a diameter larger than 50 mm should be sized for frictional loss which does not exceed 400 Pa/m and for water flow velocity which does not exceed 3 m/s. Water piping with a 50 mm in diameter or less should be sized for flow velocity which does not exceed 1.2 m/s.

11.4.1.5 Special Requirements

None

11.4.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.4.1-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Water Supply Drawings should highlight the location of the efficient domestic water pumps, the schedule, the control type, the insulation of water piping and the water pipe size.
Specifications	• The Specifications should include: (1) all the efficient domestic water pumps, (2) the control types, (3) the insulation of the water piping and sizing criteria.
New Building in Construction Phase	
Criterion Narrative	• The updated criterion narrative (if different from the Design Phase)

Submittal Name	Submittal Description
As-built Drawings	• The As-built Water Supply Drawings should highlight the location of the efficient domestic water pumps, the schedule, the control types, the insulation of water piping, and the water pipes' size.
Manufacturer Datasheets	• The Manufacturer Datasheets should include all the efficient domestic water pumps, the control types, and the insulation of the water piping and sizing criteria.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Water Supply Drawings should show the location of the efficient domestic water pumps with the schedule, the control type, the insulation of water piping and the water pipe size.
Manufacturer Datasheets	• The Manufacturer Datasheets should include of all the efficient domestic water pumps, the control type, and the insulation of water piping and sizing criteria.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.4.1.7 Score Allocation

The score for this criterion is determined based on the Efficient Water Distribution requirement. Note that the Efficient Water Distribution requirement for any specific requirement of pipe sizing and insulation, or pump efficiency and control, should be at least performed in order to qualify for this criterion. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{7} F_i * WF_i)}{(\sum_{i=1}^{7} WF_i)}\right]$$

Table 11.4.1-4. Factors and Weight Factors of Each Criterion Requirement

Criterion Requirement			Status	Factor “F”		Weight Factor “WF”	
Pipe Insulation and Sizing	**Pipe Sizing**		Yes	F_1	1	WF_1	1
			No		0		1
			N/A		0		0
	Minimum Pipe Insulation for Domestic Hot Water	60°C < T ≤ 90°C	Yes	F_2	1	WF_2	2
			No		0		2
			N/A		0		0
		40°C < T ≤ 60°C	Yes	F_3	1	WF_3	2
			No		0		2
			N/A		0		0
	Insulation protection		Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
Pump Efficiency and Control	**Pump Sizing**		Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
	Efficient Motor		Yes	F_6	1	WF_6	3
			No		0		3
			N/A		0		0
	Pump Control		Yes	F_7	1	WF_7	3
			No		0		3
			N/A		0		0

If the project does not include any criterion requirement for pipe insulation and sizing, and pump efficiency and control, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all criterion requirements are met.

11.4.2En-4.2: Domestic Hot Water Energy

11.4.2.1 Criterion Reference and Title

En-4.2: Domestic Hot Water Energy

11.4.2.2 Criterion Type

Optional

11.4.2.3 Intent

To reduce the required energy for domestic water heating by reducing the demand for hot water.

11.4.2.4 General Requirements

Reduce the project's energy use for heating domestic water by selecting low-flow fixtures which will reduce the demand for hot water. Water efficient flow fixtures include

- Lavatory faucets (private and public)
- Kitchen faucets
- Showerheads
- Ablution fixtures.

The energy needed for hot water generation can be calculated using the formula below:

$$Q_{DHW} = \frac{M * C * \Delta T}{\eta_{DHW}}$$

Where:

- Q_{DHW} = Energy required for domestic hot water generation (kilojoules)
- M = Domestic hot water demand (kg) – Baseline and design volumes can be determined from Wa-2 calculator. Typically, hot water can be considered to be 1/3 of the total annual flow volume.
- C = Specific heat of water = 4.181 kJ/kg. °C
- ΔT = Water temperature difference (°C) = Hot water temperature (°C) – Inlet water temperature (°C)

  Hot water temperature is usually set at 60°C (higher storage temperatures might be required for specific applications). Inlet water temperature depends on the source of water and the location of the project.
- η_{DHW} = Efficiency of the domestic hot water generator – Typical efficiency values are shown in the table hereunder.

Table 11.4.2-1. Typical Efficiencies of DHW Generators

DHW Generator	Energy Source	Efficiency
Electric Water Heaters	Electrical	100%
Non-Condensing Boiler	Fossil Fuel	70-85%
Condensing Boiler	Fossil Fuel	90-95%
Electric Heat Pump	Electrical	250% +

The percentage reduction between the baseline and the design case can be calculated using the formula below:

$$DHW\ Energy\ Reduction = \frac{Baseline\ DHW\ Annual\ Energy - Design\ DHW\ Annual\ Energy}{Baseline\ DHW\ Annual\ Energy} * 100$$

The score for this criterion is determined based on the percentage reduction in DHW energy. The baseline energy for this criterion is calculated by assuming that all hot water demand is supplied by electric resistance heating.

11.4.2.5 Special Requirements

None

11.4.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.4.2-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications for Fixtures and Fittings	• The Specifications should indicate the flow rates of the proposed fixtures and the flow regulation fittings at the system pressure.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturer Datasheets of Fixtures and Fittings	• The Manufacturer Datasheets should indicate the flow rates of the installed fixtures and the flow regulation fittings at the system pressure.

Submittal Name	Submittal Description
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturer Datasheets of Fixtures and Fittings	- The Manufacturer Datasheets should indicate the flow rates of the installed fixtures and the flow regulation fittings at the system pressure.
Flow Measurements	- The flow measurements should be performed on a sample of each type of water fixture to determine the flow at the actual operating pressure.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.4.2.7 Score Allocation

The score for this criterion is determined based on the achieved DHW Energy Reduction. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = \ 100 * F_1$$

Where:

- F_1 is calculated using the following formula:
  If **DHW Energy Reduction** ≤ 50%, $F_1 = \frac{DHW\ Energy\ Reduction}{0.5}$
  If **DHW Energy Reduction** > 50%, $F_1 = 1$

A project earns a score of 100% if the achieved DHW energy reduction is equal to or higher than 50%.

11.4.3En-4.3: Efficient Water Heating

11.4.3.1 Criterion Reference and Title

En-4.3: Efficient Water Heating

11.4.3.2 Criterion Type

Optional

11.4.3.3 Intent

To support an effective water heating design, and to select and install an efficient water heating system, which will save energy significantly and reduce operating costs.

11.4.3.4 General Requirements

A) Domestic Water Heater Efficiency

Demonstrate that the capacity of the efficient domestic water heaters is determined, and that the first hour rating, the fuel type, and the overall cost are considered. All domestic hot water heaters shall have a minimum of efficiency requirements as listed in the ASHRAE std. 90-1-2019 reference table hereunder. It’s recommended to exceed these requirements by using heat recovery, solar energy, or high-efficiency equipment.

Table 11.4.3-1. Minimum Efficiency for Domestic Water Heaters – the ASRHAE std. 90.1-2019 Reference Table

Water Heater System Type	Minimum Efficiency Reference Table (ASHRAE std. 90.1-2019)
Domestic Water Heaters	Table F-2

B) Domestic Water Heater Insulation

The storage tank shall be insulated with an R-2.2 high resistance insulation blanket. To ensure that the blanket stays in place, a wire, a twine or straps shall be used.

C) Heat Trap

A heat trap is a valve or loop of pipe which allows water to flow into a water heater tank. By preventing unwanted hot-water from overflowing, a heat trap saves energy, and prevents the water-heating bill from soaring. A heat trap preserves the hot water and prevents it from cooling in water heaters by thermosyphoning (natural convection). The valves in the hot water line are designed differently from the ones in the cold-water line. The vertical pipe risers of a non-recirculating system, which are connected to the storage water heater tank, shall have heat traps installed as close as possible to the storage tank on both the inlet and the outlet piping.

D) Water outlet temperature

The water outlet temperature in private bathrooms, toilets and public restrooms must not exceed 43°C. Temperature controls must be provided to allow a set point of 43°C for guest rooms in hotels, and patient rooms in healthcare. As for other occupancies, it must be set at 32°C.

E) Pool Water Heater Efficiency

Demonstrate that the size of the efficient water heaters is determined, and the first hour rating, the fuel type, and the overall cost are considered. All pool water heaters shall have the minimum efficiency requirements listed in the ASHRAE std. 90-1-2019 reference table hereunder. It's recommended to exceed these requirements by using heat recovery, solar energy, or high-efficiency equipment.

Table 11.4.3-2. Minimum Efficiency for Pool Heaters – the ASRHAE std. 90.1-2019 Reference Table

Water Heater System Type	Minimum Efficiency Reference Table (ASHRAE std. 90.1-2019)
Pool Heaters	Table F-2

F) Additional Pool Water Heater Requirements

Pool heaters shall be equipped with a readily accessible On/Off switch to allow shutting off the heater without adjusting the thermostat setting. If pools are heated to more than 32°C, a pool cover with a minimum insulation value of R-2.1 shall be provided.

11.4.3.5 Special Requirements

By maintaining water temperature as low as possible, energy will be saved, corrosion will be reduced, water heaters and their components will be scaled, and scalding safety will be improved. Careful maintenance practices shall be implemented to reduce the risk of contamination by the bacteria which cause Legionnaire's Disease, and which can be found in service water heating systems maintained below 46°C. In health-care facilities or service-water systems maintained below 60°C, periodic flushing of the fixtures with high temperature water or other biological controls may be appropriate.

11.4.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.4.3-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Water Supply Drawings should (1) show the location of all the types of domestic and pool water heating systems and (2) indicate their efficiency factor.
Specifications	• The Specifications should detail the domestic and pool water-heating system, its control and its accessories.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Water Supply Drawings should (1) show the location of all the types of domestic and pool water heating systems and (2) indicate the efficiency factor.
Manufacturer Datasheets	• The Manufacturer Datasheets should detail the domestic and pool water-heating system, its control and its accessories.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Water Supply Drawings should (1) show the location of all the types of domestic and pool water heating systems and (2) indicate the efficiency factor.
Manufacturer Datasheets	• The Manufacturer Datasheets should detail the domestic and pool water-heating system, its control and its accessories.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting

documents, which can provide additional relevant information for the certification reviewers to consider.

11.4.3.7 Score Allocation

The score for this criterion is determined based on the Efficient Water Heating requirement. Note that in order to qualify for this criterion, at least one of the efficient water heating requirements should be performed. In order to determine the criterion score, the following formula is applied.

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{7} F_i * WF_i)}{(\sum_{i=1}^{7} WF_i)}\right]$$

Table 11.4.3-4. Factors and Weight Factors of Each Criterion Requirement

Criterion Requirement			**Status**	**Factor “F”**		**Weight Factor “WF”**	
Domestic Water Heater	**Domestic Water Heater Efficiency**		Yes	F_1	1	WF_1	S_1
			N/A		0		0
	Additional Domestic Water Heater Requirements	**Heat Trap**	Yes	F_2	1	WF_2	0.2
			No		0		0.2
			N/A		0		0
		Tank Insulation	Yes	F_3	1	WF_3	0.2
			No		0		0.2
			N/A		0		0
		Water Outlet Temperature	Yes	F_4	1	WF_4	0.2
			No		0		0.2
			N/A		0		0
Pool Heater	**Pool Heater Efficiency**		Yes	F_5	1	WF_5	S_2
			N/A		0		0
	Additional Pool Heater Requirements	**Efficient Motor**	Yes	F_6	1	WF_6	0.2
			No		0		0.2
			N/A		0		0
		Pump Control	Yes	F_7	1	WF_7	0.15
			No		0		0.15
			N/A		0		0

As determined in the tables hereunder,

Where:

S_1: Score for domestic water heater efficiency requirement

S_2: Score for pool water heater efficiency requirement

Table 11.4.3-5. Score "S1" for Domestic Water Heater Efficiency Requirement

Domestic Water Heater Efficiency Requirement	Score “ S_1 ”
$UEF_{(Design)} < UEF_{(Target)}$	0%
$UEF_{(Design)} = UEF_{(Targt)}$	60%
$UEF_{(Target)} \leq UEF_{(Design)} \leq 1.5 \times UEF_{(Target)}$	60% ≤ Score ≤ 100%

Table 11.4.3-6. Score "S2" for Pool Water Heater Efficiency Requirement

Pool Water Heater Efficiency Requirement	Score “ S_2 ”
$EF_{(Design)} < EF_{(Target)}$	0%
$EF_{(Design)} = EF_{(Target)}$	60%
$EF_{(Target)} \leq EF_{(Design)} \leq 1.5 \times EF_{(Target)}$	60% ≤ S_2 ≤ 100%

Where:

$UEF_{(Design)}$ = Weighted average of the designed uniform energy factor for domestic water heater

$UEF_{(Target)}$ = Weighted average of the targeted uniform energy factor for domestic water heater

$EF_{(Design)}$ = Weighted average of the designed energy efficiency for pool water heater

$EF_{(Target)}$ = Weighted average of the targeted energy efficiency for pool water heater

If the project does not include any criterion requirement for an efficient domestic water heating system or a pool water heating system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if (1) all the criterion requirements for efficient domestic water and pool water heating systems are met, and (2) the minimum designed efficiencies shall be more or equal to one and a half of the targeted efficiencies.

11.5 Family: Lighting

11.5.1En-5.1: Efficient Lighting Fixtures

11.5.1.1 Criterion Reference and Title

En-5.1: Efficient Lighting Fixtures

11.5.1.2 Criterion Type

Optional

11.5.1.3 Intent

To support the usage of efficient lights to minimize the energy consumption.

11.5.1.4 General Requirements

Interior Building Light Power

No incandescent lamps shall be used in the project. All interior lights shall make use of more-efficient lighting technologies, such as LEDs. It is a step towards a more relevant reduction in the lighting systems' power consumption. The luminous efficacy of all interior lights shall be 80 lm/W, at a minimum. All interior fluorescent lights must incorporate high frequency electronic ballasts.

The interior lighting power allowance of an entire building or an entire occupancy in a multi-occupancy building shall be determined by the Building Area Method. It shall be calculated as per the ASHRAE std. 90-1-2019 reference table and as the provided equation below.

Table 11.5.1-1. Interior Lighting Power Density – the ASRHAE std. 90.1-2019 Reference Table

Lighting System Type	**Light Power Density Reference Table (ASHRAE std. 90.1-2019)**
Interior Lighting Power Densities	Table G3.8

$$\boldsymbol{LPD}^{(\boldsymbol{Internal})}_{(\boldsymbol{Target})}(\mathrm{W}) = \text{Gross Building lighted floor areas}(\mathrm{m}^2) \times \mathrm{LPD}(\mathrm{W/m}^2)$$

$LPD^{(Interior)}_{(Target)}$ is the targeted Light Power Density of the interior lighting system. The gross lighted area of the building is the gross floor area of lighted spaces in the building. It includes basements, mezzanines and intermediate-floor tiers, and penthouses, provided these spaces have a headroom height of 2.3 m or greater. The gross lighted area is measured either from the exterior faces of exterior walls or from the centerline of walls separating buildings. The gross lighted area excludes (1) covered walkways, open roofed-over areas, porches, exterior terraces or steps, etc., and (2) pipe trenches, chimneys, roof overhangs, and any other similar features.

For a mixed-use building, the interior lighting power allowance is the sum of the lighting power allowances of all the building area types.

The wattage of lighting fixtures shall be the manufacturers' labeled maximum wattage, which shall include all the power used by the luminaires, including lamps, ballasts/drivers, transformers, and control devices.

The lighting which shall be excluded from the total interior lighting power allowance calculation comprises the lighting for safety and emergency in hazardous locations, signage and display lights, water fountains, indoor swimming pool lights, and associated storage area lights.

Exterior Building Light Power

The total exterior lighting power allowance is the sum of the base site allowance plus the individual allowances for designed illuminated areas as per the ASHRAE std. 90-1-2019 reference table and the provided equation below.

Table 11.5.1-2. Exterior Lighting Power Density – the ASRHAE std. 90.1-2019 Reference Table

Lighting System Type	Light Power Density Reference Table (ASHRAE std. 90.1-2019)
Exterior Lighting Power Densities	Table G3.6

$$\boldsymbol{LPD}^{(\boldsymbol{External})}_{(\boldsymbol{Target})} = Base\ Allowance(W) + \sum_{i=1}^{n} LPD_i(W/m^2)\ \times\ A_i(m^2) + \sum_{j=1}^{n} LPD_j(W/m)\ \times L_j(m)$$

Where $LPD^{(Exterior)}_{(Target)}$ is the targeted Light Power Density of the exterior lighting system

The lighting, which shall be excluded from the total exterior lighting power allowance calculations, comprises the lighting for safety and hazardous locations, signage and display lights, recreational areas, water fountains, outdoor swimming pools, and associated storage areas.

11.5.1.5 Special Requirements

None

11.5.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.5.1-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Lighting Drawings of all the proposed exterior and interior lighting systems should be submitted.
Specifications	• The Specifications should detail all the proposed exterior and interior lighting systems.
Calculations	• The Light Power Density (LPD) Calculations should include the luminaire schedule with the number, the location, the power and the type of each interior and exterior light used in the project.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-built Drawings	• The As-built Lighting Drawings of all the proposed exterior and interior lighting systems.
Manufacturer Datasheets	• The Manufacturer Datasheets should detail the installed exterior and interior lighting systems.
Calculation	• The updated LPD Calculation with Luminaire schedule (if different from the Design Phase)
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Lighting Drawings of all the proposed exterior and interior lighting systems.
Manufacturer Datasheets	• The Manufacturer Datasheets should detail the installed exterior and interior lighting systems.
Calculations	• The Light Power Density (LPD) Calculations should include the luminaire schedule with the number, the location, the

Submittal Name	Submittal Description
	power and the type of each interior and exterior light used in the project.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.5.1.7 Score Allocation

The score for this criterion is determined based on the Light Power Density (LPD) requirement. Note that the design Light Power Density value $\boldsymbol{LPD_{(Design)}}$ should be at least equal to the targeted light power density $\boldsymbol{LPD_{(Target)}}$ in order to qualify for this criterion. The criterion score is determined according to the table hereunder.

Table 11.5.1-4. Criterion Score for Light Power Density "LPD" Requirement

Light Power Density “LPD” Requirement	Criterion Score
$LPD_{(Design)} > LPD_{(Target)}$	0%
$LPD_{(Design)} = LPD_{(Target)}$	60% (prerequisite)
$LPD_{(Target)} \geq LPD_{(Design)} \geq 0.75 \times LPD_{(Target)}$	60% ≤ Criterion Score ≤ 100%

Where:

$LPD_{(Design)}$ and $LPD_{(Target)}$ are calculated using the following formulas:

$$\boldsymbol{LPD_{(Design)} = LPD_{(Design)}^{(Interior)} + LPD_{(Design)}^{(Exterior)}}$$

$LPD_{(Design)}$ = Designed Light Power Density of the total lighting system

$LPD_{(Design)}^{(Interior)}$ = Designed Light Power Density of the interior lighting system

$LPD_{(Design)}^{(Exterior)}$ = Designed Light Power Density of the exterior lighting system

$$\boldsymbol{LPD_{(Target)} = LPD_{(Target)}^{(Interior)} + LPD_{(Target)}^{(Exterior)}}$$

$LPD_{(Target)}$ = Targeted Light Power Density of the total lighting system

$LPD_{(Target)}^{(Interior)}$ = Targeted Light Power Density of the interior lighting system

$LPD_{(Target)}^{(Exterior)}$ = Targeted Light Power Density of the exterior lighting system

11.5.2 En-5.2: Lighting Controls

11.5.2.1 Criterion Reference and Title:

En-5.2: Lighting Controls

11.5.2.2 Criterion Type

Optional

11.5.2.3 Intent

To support the usage of lighting controls to minimize energy consumption.

11.5.2.4 General Requirements

Lighting control systems can include the following control devices: manual wall switch, occupancy sensor, daylight sensor, photocell, time clock.

All lighting control systems shall be readily accessible and located so that the occupants can see the controlled lighting when using the control device. Building lighting controls shall be installed and to comply with the lighting control requirements of the following tables for exterior lighting control and interior lighting control.

Table 11.5.2-1. Exterior Lighting Control

EXTERIOR LIGHTING CONTROL	
IN GENERAL	All exterior lighting shall be automatically controlled by either a photocell or an astronomical time switch to shut off the lighting when daylight is available.
BUILDING FAÇADE AND LANDSCAPE LIGHTING	All building façade and landscape lighting shall be automatically shut off between from 12:00 a.m. or within one hour of the end of business operations, whichever is later, until 6 a.m. or the business opening hour, whichever is earlier, or between times established by the authority having jurisdiction.
	Lighting for signage shall be controlled to automatically reduce the connected lighting power by at least 50% from 12:00 a.m., or within one hour of the end of business operations, whichever is later, until 6 a.m. or the business opening hour,, whichever is earlier, or during any period when no activity has been detected for a time of no longer than 15 minutes.

OUTDOOR PARKING AREAS	Luminaires serving outdoor parking areas shall be controlled to automatically reduce the power of each luminaire by a minimum of 50% when no activity has been detected in the area illuminated by the controlled luminaires for a time of no longer than 15 minutes. No more than 1500 W of lighting power shall be controlled together.

Table 11.5.2-2. Interior Lighting Control

INTERIOR LIGHTING CONTROL	
GENERAL AND TRANSITION AREAS	Occupancy sensors, which shall be installed in all hallways, corridors, stairwells and restrooms, will reduce the lighting power by a minimum of 50% when no activity is detected for no longer than 20 minutes. They shall be controlled to turn off when the building is either unoccupied or scheduled to be unoccupied.
INDOOR PARKING GARAGES	Parking garage lighting shall have automatic lighting shutoff. The lighting power of each luminaire shall be automatically reduced by a minimum of 30% when there is no activity detected within a lighting zone for 20 minutes.
	As for covered vehicle entrances, exits, and parking structures in a building, the lighting shall be separately controlled by a device which automatically reduces the lighting by at least 50% from sunset to sunrise.
OFFICE	Occupancy sensors shall be installed in all conference or meeting rooms, open plan offices, and spaces greater than 23 m2.
	Office spaces, conference rooms, meeting rooms, libraries, and storage rooms smaller than 23m2 shall also be controlled by manual-On occupant sensors and continuous daylight dimming controls.
HOTEL	All lighting in guestrooms and suites in hotels, motels or similar buildings shall be automatically controlled. The power to the lighting will be turned off within 20 minutes of the departure of all occupants.
	Bathrooms in guestrooms shall have a separate control device installed. It will automatically turn off the bathroom lighting within 30 minutes of the departure of all occupants.
	Task lighting including the under-cabinet or under-shelf lighting shall be equipped with either a local control independent of the general lighting control, or a control device integral to the luminaires.
EDUCATIONAL	All the lighting shall be controlled to turn off automatically when the building is either unoccupied or scheduled to be unoccupied.
	Classrooms shall be controlled by manual-On occupant sensors.

MALL	Sales areas shall be controlled (1) to reduce the general lighting power by a minimum of 75% during non-business hours, (2) to turn off all lighting other than general lighting during non-business hours, and (3) to use continuous daylight dimming controls in spaces with top lighting.
	Task lighting, display lighting, and accent lighting shall be equipped with a local control independent of the general lighting control.
HOSPITAL	Patients' bathrooms and public toilets shall have a separate control device installed to automatically turn off the bathroom/toilet lighting within 15 minutes from the departure of all occupants.
RESIDENTIAL	Occupancy sensors, which shall be installed in the building's main entrance, the corridors, and the stairwells, will turn off the lighting within 20 minutes of the departure of all occupants.

11.5.2.5 Special Requirements

None

11.5.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.5.2-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• The Lighting Drawings should show the lighting control system intended for all the proposed exterior and interior lighting system.
Specifications	• The Specifications should include all the details of the lighting control system intended for all the proposed exterior and interior lighting system.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)

Submittal Name	Submittal Description
As-built Drawings	- The As-built lighting drawings should show the lighting control system for all the installed exterior and interior lighting system.
Manufacturer Datasheets	- The Manufacturer Datasheets of lighting control system used for exterior and interior lighting system.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	- The As-built lighting drawings should show the lighting control system for all the installed exterior and interior lighting system.
Manufacturer Datasheets	- The Manufacturer Datasheets of the lighting control system used for exterior and interior lighting system should be provided.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.5.2.7 Score Allocation

The score for this criterion is determined based on the lighting control of interior and exterior lighting requirements. Note that in order to qualify for this criterion, at least one of the lighting control requirements shall be performed. In order to determine the criterion score, the following formula is applied for each building sector:

OFFICE

$$Criterion\ Score = 100 * \left[\frac{\left(\sum_{i=1}^{8} F_i * WF_i\right)}{\left(\sum_{i=1}^{8} WF_i\right)}\right]$$

Table 11.5.2-4. Factors and Weight Factors of Each Criterion Requirement for the Office Sector

OFFICE	Criterion Requirements		Status	Factor “F”		Weight Factor “WF”	
	EXTERIOR LIGHTING CONTROL	IN GENERAL	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		BUILDING FAÇADE AND LANDSCAPE LIGHTING	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
			Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		OUTDOOR PARKING AREAS	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
	INTERIOR LIGHTING CONTROL	GENERAL AND TRANSITION AREAS	Yes	F_5	1	WF_5	2
			No		0		2
			N/A		0		0
		INDOOR PARKING GARAGES	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		OFFICE	Yes	F_7	1	WF_7	3
			No		0		3
			N/A		0		0
			Yes	F_8	1	WF_8	2
			No		0		2
			N/A		0		0

If the project does not include any lighting control system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned lighting control system requirements are performed.

MALL

$$Criterion\ Score = 100 * \left[\frac{\left(\sum_{i=1}^{8} F_i * WF_i\right)}{\left(\sum_{i=1}^{8} WF_i\right)}\right]$$

Table 11.5.2-5. Factors and Weight Factors of Each Criterion Requirement for the Mall Sector

	Criterion Requirements		Status	Factor "F"		Weight Factor "WF"	
MALL	EXTERIOR LIGHTING CONTROL	IN GENERAL	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		BUILDING FAÇADE AND LANDSCAPE LIGHTING	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
			Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		OUTDOOR PARKING AREAS	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
	INTERIOR LIGHTING CONTROL	GENERAL AND TRANSITION AREAS	Yes	F_5	1	WF_5	2
			No		0		2
			N/A		0		0
		INDOOR PARKING GARAGES	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		MALL	Yes	F_7	1	WF_7	3
			No		0		3
			N/A		0		0
			Yes	F_8	1	WF_8	2
			No		0		2
			N/A		0		0

If the project does not include any lighting control system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned lighting control system requirements are performed.

HOTEL

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{9} F_i * WF_i)}{(\sum_{i=1}^{9} WF_i)}\right]$$

Table 11.5.2-6. Factors and Weight Factors of Each Criterion Requirement for the Hotel Sector

	Criterion Requirements		Status	Factor “F”		Weight Factor “WF”	
HOTEL	**EXTERIOR LIGHTING CONTROL**	**IN GENERAL**	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		BUILDING FAÇADE AND LANDSCAPE LIGHTING	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
			Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		OUTDOOR PARKING AREAS	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
	INTERIOR LIGHTING CONTROL	**GENERAL AND TRANSITION AREAS**	Yes	F_5	1	WF_5	2
			No		0		2
			N/A		0		0
		INDOOR PARKING GARAGES	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		HOTEL	Yes	F_7	1	WF_7	3
			No		0		3
			N/A		0		0
			Yes	F_8	1	WF_8	3
			No		0		3
			N/A		0		0
			Yes	F_9	1	WF_9	2
			No		0		2
			N/A		0		0

If the project does not include any lighting control system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned lighting control system requirements are performed.

EDUCATIONAL FACILITIES

$$Criterion\ Score = 100 * \left[\frac{\left(\sum_{i=1}^{8} F_i * WF_i\right)}{\left(\sum_{i=1}^{8} WF_i\right)}\right]$$

Table 11.5.2-7. Factors and Weight Factors of Each Criterion Requirement for Educational Sector

	Criterion Requirements		Status	Factor “F”		Weight Factor “WF”	
EDUCATIONAL	**EXTERIOR LIGHTING CONTROL**	**IN GENERAL**	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		BUILDING FAÇADE AND LANDSCAPE LIGHTING	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
			Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		OUTDOOR PARKING AREAS	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
	INTERIOR LIGHTING CONTROL	**GENERAL AND TRANSITION AREAS**	Yes	F_5	1	WF_5	2
			No		0		2
			N/A		0		0
		INDOOR PARKING GARAGES	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		EDUCATIONAL	Yes	F_7	1	WF_7	3
			No		0		3
			N/A		0		0
			Yes	F_8	1	WF_8	3
			No		0		3
			N/A		0		0

If the project does not include any lighting control system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned lighting control system requirements are performed.

HOSPITAL

$$Criterion\ Score = 100 * \left[\frac{(\sum_{i=1}^{7} F_i * WF_i)}{(\sum_{i=1}^{7} WF_i)}\right]$$

Table 11.5.2-8. Factors and Weight Factors of Each Criterion Requirement for the Hospital Sector

		Criterion Requirements	Status	Factor "F"		Weight Factor "WF"	
HOSPITAL	**EXTERIOR LIGHTING CONTROL**	**IN GENERAL**	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		BUILDING FAÇADE AND LANDSCAPE LIGHTING	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
			Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		OUTDOOR PARKING AREAS	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
	INTERIOR LIGHTING CONTROL	**GENERAL AND TRANSITION AREAS**	Yes	F_5	1	WF_5	2
			No		0		2
			N/A		0		0
		INDOOR PARKING GARAGES	Yes	F_6	1	WF_6	1
			No		0		1
			N/A		0		0
		HOSPITAL	Yes	F_7	1	WF_7	3
			No		0		3
			N/A		0		0

If the project does not include any lighting control system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned lighting control system requirements are performed.

RESIDENTIAL

$$Criterion\ Score = \ 100 * \left[\frac{(\sum_{i=1}^{6} F_i * WF_i)}{\left(\sum_{i=1}^{6} WF_i\right)}\right]$$

Table 11.5.2-9. Factors and Weight Factors of Each Criterion Requirement for the Hospital Sector

HOSPITAL	Criterion Requirements		Status	Factor “F”		Weight Factor “WF”	
	EXTERIOR LIGHTING CONTROL	IN GENERAL	Yes	F_1	1	WF_1	2
			No		0		2
			N/A		0		0
		BUILDING FAÇADE AND LANDSCAPE LIGHTING	Yes	F_2	1	WF_2	1
			No		0		1
			N/A		0		0
			Yes	F_3	1	WF_3	1
			No		0		1
			N/A		0		0
		OUTDOOR PARKING AREAS	Yes	F_4	1	WF_4	1
			No		0		1
			N/A		0		0
	INTERIOR LIGHTING CONTROL	INDOOR PARKING GARAGES	Yes	F_5	1	WF_5	1
			No		0		1
			N/A		0		0
		RESIDENTIAL	Yes	F_6	1	WF_6	3
			No		0		3
			N/A		0		0

If the project does not include any lighting control system, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the aforementioned lighting control system requirements are performed.

11.6 Family: Energy Efficient Equipment

11.6.1En-6.1: Energy Efficient Appliances

11.6.1.1 Criterion Reference and Title

En-6.1: Energy Efficient Appliances

11.6.1.2 Criterion Type

Optional

11.6.1.3 Intent

To support the usage of energy efficient appliances to minimize the energy consumption.

11.6.1.4 General Requirements

All installed appliances must hold one of the following:

- Energy Star certification
- Minimum “A” rating under the EU Energy Efficiency Labeling Scheme
- Equivalent rating scheme which meets or exceeds Energy Star or EU Energy Efficiency Labeling Scheme.

Efficient appliances can be classified, but are not limited to, the following categories:

- Office appliances: laptop, pc, monitor, printer, scanner, copier, fax, television, etc.
- Refrigeration appliances: refrigerator, fridge, freezer, refrigeration cases, etc.
- Kitchen appliances: dishwasher, cooker, cooler, cooking appliances, heater, hood, etc.
- Laundry appliances: washing machine, dryer, washer-dryer, etc.

The appliances template on the ARZ shall be filled with a list of all of the efficient and non-efficient appliances. The total percentage of energy efficient appliances is equal to the number of energy efficient appliances over to the total number of all appliances to be used in the building. It can be determined by the following equation:

$$\%\, Energy\ Efficient\ Appliances = \ 100\ * \frac{Number\ of\ Energy\ Efficient\ Appliances}{Total\ number\ of\ all\ appliances}$$

11.6.1.5 Special Requirements

None

11.6.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.6.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Summary List of All the Appliances	• On the ARZ, a summary list of all the appliances to be installed in the building should be filled. The number of these appliances and their energy label certification should be included.
Specifications	• The Specifications should include the proposed energy efficient appliances, their features, and their energy label certification.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
Summary List of All Appliances	• The updated Summary list of all the appliances (if different from the Design Phase)
Manufacturer Datasheets	• The Manufacturer Datasheets should include the installed energy efficient appliances, their features, and their energy label certifications.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Summary List of All Appliances	• The summary list of all the appliances installed in the building should be filled on the ARZ. The number of these appliances and their energy label certifications should be included.

Submittal Name	Submittal Description
Manufacturer Datasheets	- The Manufacturer Datasheets should include the installed energy efficient appliances, their features, and their energy label certifications.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.6.1.7 Score Allocation

In order to determine the criterion score, the following formula is applied:

$$Criteron\ Score\ (\%) = \ \%\ \ Energy\ Efficient\ Appliances$$

If all the appliances used are non-efficient, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the appliances used are efficient.

11.6.2En-6.2: Energy Efficient Elevator/Escalator/Travelator

11.6.2.1 Criterion Reference and Title

En-6.2: Energy Efficient Elevator/Escalator/Travelator

11.6.2.2 Criterion Type

Optional

11.6.2.3 Intent

To support the usage of energy efficient transportation to minimize the energy consumption.

11.6.2.4 General Requirements

A) Energy Efficient Elevators

Demonstrate that all elevators inside the building are energy efficient as follows:

- Use LED lighting and LCD/LED display.
- Include a regenerative drive system (for two-floor buildings and over only).
- Include Variable-Voltage/Variable-Frequency (VVVF) control of the drive motor.
- Offer “idle/downtime” features to operate in a standby mode during off-peak periods.

B) Energy Efficient Escalators and Travelators

Demonstrate that all escalators/travelators inside the building are energy efficient as follows:

- Use LED strip lighting.
- Offer an automated operation linked to occupancy sensors
  (1) To enable the standby mode when there is no passenger demand, or
  (2) To include a Variable Speed Drive (VSD) control of the drive motor which responds to load-sensing as per passenger demand.

11.6.2.5 Special Requirements

None

11.6.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.6.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Specifications	• The Specifications should include the proposed energy efficient elevators/escalators and their features.
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
Manufacturer Datasheets	• The Manufacturer Datasheets should include the installed energy efficient elevators/escalators and their features.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturer Datasheets	• The Manufacturer Datasheets should include the installed energy efficient elevators/escalators and their features.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.6.2.7 Score Allocation

The score for this criterion is determined based on efficient elevator/escalator/travelator requirements. In order to qualify for this criterion, the building should either have efficient elevators or efficient escalators. Factors and weight factors are applied to each requirement as follows.

Table 11.6.2-2. Factors and Weight Factors for Each Criterion Requirement

Criterion Requirements	Status	Factor "F"		Weight Factor "WF"	
Energy Efficient Elevators	Yes	F_1	1	WF_1	1
	No		0		1
	N/A		0		0
Energy Efficient Escalators and Travelators	Yes	F_2	1	WF_2	1
	No		1		1
	N/A		1		0

The calculator will determine the exact score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{(F_1 * WF_1) + (F_2 * WF_2)}{(WF_1 + WF_2)}\right]$$

If the project does not include any efficient elevators/escalators, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if all the elevators/escalators presented in the project are efficient.

11.6.3En-6.3: Electrical Power Quality

11.6.3.1 Criterion Reference and Title

En-6.3: Electrical Power Quality

11.6.3.2 Criterion Type

Optional

11.6.3.3 Intent

To reduce the impact of poor electrical power quality on the building systems in order to reduce energy losses and improve building systems' performance.

11.6.3.4 General Requirements

The electric power quality refers to the degree to which electrical parameters (such as voltage, frequency and waveform) conform to the established specifications. This criterion focuses on the power quality parameters below:

- Power Factor
- Harmonics
- Voltage Unbalance
- Voltage Drop.

Power Factor

The Power Factor (PF) is the ratio of real power (measured in kilowatts kW) to apparent power (measured in kilovolt amperes kVA):

$$PF = \frac{Real\ Power\ (kW)}{Apparent\ Power\ (kVA)}$$

The Power Factor should always be maintained as high as possible (≈1) in order to avoid network issues, such as

- Power system losses due to high currents
- High voltage drops
- Reactive power penalty charges
- Electrical component failures.

The Power Factor can be rectified by installing capacitor banks within the distribution system.

Harmonics

Harmonics in electrical power systems refer to voltage or current waveforms whose frequency is an integer multiple of the fundamental frequency (50Hz in Lebanon), and which cause distortion of the sinusoidal wave.

Common problems caused by harmonics include
- Losses in transmission and in distribution systems
- Overheating in electrical motors and transformers
- Failures in sensitive electronic devices and control systems
- Resonance risks at high frequencies in systems.

Electrical system harmonics can be rectified by installing harmonic filters on the source equipment, and by selecting ultra-low harmonic drives to reduce disturbance.

Voltage Unbalance

The voltage unbalance refers to the variation in the voltage magnitude between different phases in a three-phase distribution network. It is primarily due to either the unequal loads on the distribution lines within a Facility or the malfunctioning equipment.

Overheating and damaging the electrical three-phase motors is the most common problem resulting from voltage unbalance, and which can be avoided by properly distributing and equalizing the loads between the different phases.

Voltage Drop

The voltage drop refers to the decrease in electrical potential along the electrical distribution network due to losses within the feeder conductors and the branch circuits. The voltage drop is mainly the result of an increased circuit resistance, which is typically caused by an increased load or power draw to supply the connected equipment.

The voltage drop can be a serious problem if the supply voltage becomes lower than the acceptable rated values of the connected equipment. It could lead to the overheating and the failure of the equipment.

The simplest method to fix the voltage drop in an electrical network is to properly size the conductors (cross section of wires and cables) between the source and the load, thus avoiding increased resistance losses.

The table hereunder includes the requirements for each electrical power quality parameter listed earlier to comply with this criterion.

Table 11.6.3-1. Power Quality Requirements

Power Quality Parameter	Requirements
Power Factor	A Building Power Factor assessment should be performed. • The resultant monthly average power factor should not exceed 0.9 (PF > 0.90).
Harmonics	A Building Harmonics study should be performed. • The voltage distortion limits (IEEE Standard 519-2014) should not be exceeded (Total harmonics distortion THD < 8%, Individual harmonics < 5%). • The current distortion limits (IEEE Standard 519-2014) should not be exceeded. (Ref. Table 14.2.1-2)
Voltage Unbalance	A Building Voltage Unbalance assessment should be performed. • The voltage unbalance should not exceed 3% at the electric utility meter and 2% at the three-phase electrical motors.
Voltage Drop	A Building voltage drop analysis should be performed. • The voltage drop from the feeder conductors and the branch circuits should not exceed 5% at the design load. • The voltage drop from the feeder conductors or the branch circuits should not exceed 3% at the design load.

Table 11.6.3-2. Current Distortion Limits for Systems Rated 120V Through 69kV (IEEE 519-2014)

I_{SC}/I_L	Individual Harmonic Limits (Odd Harmonics) [a]					TDD Required
	h<11	11≤h<17	17≤h<23	23≤h<35	35≤h	
<20 [b]	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

[a] Even harmonics are limited to 25% of the odd harmonic limits above.

[b] All power generation equipment is limited to these vales of current distortion regardless of actual I_{SC}/I_L.

I_{SC} = Maximum short circuit current at PCC

I_L = Maximum demand load current (fundamental frequency component) at PCC

h = Harmonics order

TDD = Total demand distortion based on the maximum demand current at the fundamental frequency taken at the PCC

PCC = Point of common coupling between the system owner or operator and the system users

11.6.3.5 Special Requirements

None

11.6.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.6.3-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design Drawings	• The Design Drawings should include the floor layouts and the single line diagrams which show that the proposed equipment meets the requirements of the electrical power quality parameters.
Design Specifications	• The Design Specifications should show that all the proposed equipment meets the requirements of the electrical power quality parameters (i.e., power factors correction units, harmonics filters, conductors, etc.)
Design Calculations	• The Design Calculations should include all the necessary calculations to confirm compliance with the power quality parameters (i.e., power factor correction unit sizing, harmonics filters sizing, power load distribution, conductor sizing and voltage drop calculations).
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As- built Drawings should include the floor layouts and the single line diagrams which show that the installed equipment meets the requirements of the electrical power quality parameters.
Manufacturer Datasheets	• The Manufacturer Datasheets should show that all the installed equipment meets the requirements of the electrical power quality parameters (i.e., power factors, correction units, harmonics filters, conductors, etc.).

Submittal Name	Submittal Description
As-built Calculations / Measurements	• The As-built Calculations should include the The updated calculations to confirm compliance with the power quality parameters (i.e., power factors, correction unit sizing, harmonics filters sizing, power load distribution, conductor sizing, and voltage drop calculations). • The actual measurements at rated conditions can also be performed to confirm compliance with the requirements of each parameter.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Manufacturer Datasheets	• The Manufacturer Datasheets should show that all the installed equipment meets the requirements of the electrical power quality parameters (i.e., power factors, correction units, harmonics filters, conductors, etc.).
Assessment Report	• The Assessment Report should include an analysis confirming the compliance with the required values of each parameter. To confirm that the actual values are within the acceptable ranges, the analysis can be performed based on any of the following: (1) historical electricity data showing the values of each parameter, (2) short term logging, (3) spot measurements at rated conditions, etc.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.6.3.7 Score Allocation

The score for this criterion is determined based on the compliance with the power quality requirements. Weight factors are applied to each requirement as follows:

Power Quality Parameter	Weight Factor (WF)	
Power Factor	23. WF_1	24. 3
Harmonics	25. WF_2	26. 3
Voltage Unbalance	27. WF_3	28. 1
Voltage Drop	29. WF_4	30. 1

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \frac{\sum Weight\ Factors\ of\ compliant\ requirements}{\sum Weight\ Factors\ of\ all\ requirements}$$

A project earns a score of 100% for this criterion by having all power quality parameters compliant with the criterion requirements.

11.7 Family: Renewable Energy Sources

11.7.1 En-7.1: Renewable Energy Sources

11.7.1.1 Criterion Reference and Title

En-7.1: Renewable Energy Sources

11.7.1.2 Criterion Type

Optional

11.7.1.3 Intent

To reduce the energy consumption of the building by utilizing renewable energy sources.

11.7.1.4 General Requirements

There are various renewable energy sources, which can be utilized in a project, to reduce the project's energy consumption and the project's reliance on fossil fuel-based power generation, which results in carbon emissions associated with the building operation.

Renewable energy technologies commonly used within buildings include

- Solar thermal panels
- Photovoltaic panels
- Wind turbines
- Biofuels
- Geothermal energy
- Other sources.

<u>Solar Water Heating</u>

A solar water heating system converts the sun's radiation into thermal energy used for hot water generation. There are various system configurations for solar thermal installations, but the main components include the following:

- Solar collectors (flat plate or evacuated tubes)
- Hot water storage tank
- Circulation pumps with a controller (required for active circulation systems)
- Auxiliary heating source (backup).

The amount of hot water which is supplied by the solar system depends mainly on the amount of solar radiation available, and the cloud cover, the orientation and the angle of the solar collectors, the type of solar collectors, and the shading effects. The following guidelines should be considered when designing a solar water heating system:

- The sizing of the solar collectors should be provided by a qualified professional based on the equipment specifications and demand.
- Ideally, solar collectors should be installed at an angle which is equal to the latitude of the location where it is installed. Other tilt angles can be considered depending on the roof configuration.
- For ultimate solar energy absorption, the collectors should be oriented to the south. However, in some cases it is possible to have the collectors facing the east or the west to increase hot water production during specific periods of the day (e.g., the collectors can be oriented to the east for morning hot water usage).
- The storage tank should be adequately sized based on the amount of hot water needed and the time of use.
- The distribution of collectors should avoid self-shading, and shading from adjacent structures in order to optimize the system's operation.
- It is recommended to use software tools to simulate the solar system's performance based on the hot water demand and the site conditions in order to optimize the storage tank capacity, sizing, placement, orientation and tilt angle of the solar collectors.

The energy needed for hot water production can be calculated using the formula below:

$$Q_{DHW} = \frac{M * C * \Delta T}{\eta_{DHW}}$$

Where:

- Q_{DHW} = The energy required for domestic hot water generation (kilo Joules)
- M = The domestic hot water demand (kg) – The baseline and the design volumes can be determined from Wa-2 calculator. Typically, the hot water can be assumed to be 1/3 of the total annual flow volume.
- C = Specific heat of water = 4.181 kJ/kg.°C
- ΔT = The water temperature difference (°C) = The hot water temperature (°C) – The inlet water temperature (°C)
  The hot water temperature is usually set at 60°C (Higher storage temperatures might be required for specific applications). The inlet water temperature depends on the source of the water and the location of the project.
- η_{DHW} = The efficiency of the domestic hot water generator – The typical efficiency values are shown in the table hereunder.

Table 11.7.1-1. Typical Efficiencies of DHW Generators

DHW Generator	Energy Source	Efficiency
Electric Water Heaters	Electrical	100%
Non-Condensing Boiler	Fossil Fuel	70-85%
Condensing Boiler	Fossil Fuel	90-95%
Electric Heat Pump	Electrical	250% +

The percentage contribution of the solar water heating system can be calculated using the formula below:

$$Percentage\ SWH\ Contribution = \frac{Thermal\ Energy\ Supplied\ by\ Solar\ Water\ Heating\ System}{Total\ Annual\ Energy\ required\ for\ Hot\ Water\ Production} * 100$$

The calculation of the thermal energy supplied by the solar water heating system and the total energy required for annual hot water generation can be determined by using either calculation tools or software simulations which should be performed by a qualified professional. The calculation tools typically include the following inputs:

- Weather data for the project’s location
- Daily hot water consumption profiles
- Storage and supply hot water temperatures
- Cold water temperature
- Auxiliary heating source
- Equipment specifications (hot water storage tank, solar collectors, circulating pumps)

A Solar Photovoltaic System

A solar photovoltaic system converts the sun’s radiation into electrical energy. The main components of photovoltaic systems include the following:

- Photovoltaic modules
- Solar inverter
- Battery storage (optional).

There are three main types of solar photovoltaic systems:

A. Off-grid: A stand-alone system with battery storage
B. On-grid: A grid-connected system also known as a grid-tie or grid-feed solar system
C. Hybrid: A grid-connected system with battery storage

On-grid solar systems are the most common and the most widely used. They are connected to the public electricity grid, where any excess energy generated by the solar system can be exported to the grid. The project is compensated through either net-metering or Feed-in-

Tariff (FiT) schemes. Net metering requires only one meter. When the solar system is producing more electricity than the facility is using, the excess energy is sent back to the utility grid for other energy consumers to use, thus the facility is credited the amount of energy exported at the same rate they pay for grid electricity. In contrast, implementing FiT requires two meters, one to measure consumption, and the other to measure generation. It can be priced at a different rate from the grid electricity.

The amount of electrical energy generated by the solar photovoltaic system depends mainly on the amount of solar radiation available and the cloud cover, the orientation and the angle of the solar panels, the type and the efficiency of the photovoltaic (PV) modules, and the shading effects. The following guidelines should be considered when designing a solar photovoltaic system:

- The sizing of the photovoltaic system should be performed by a qualified professional. It should take into consideration the energy demand of the Facility in order to avoid oversizing and energy wastage. A simulation software should be used to determine the potential annual system production.
- Ideally, solar panels should be installed with a tilt angle which is equal to the latitude of the location where it is installed. Other tilt angles can be considered depending on the roof configuration.
- For maximum energy production, the panels should be oriented to the south. However, in some cases it is possible to have the panels facing east/west orientations.
- Distribution of panels should avoid self-shading and shading from adjacent structures in order to optimize system operation.

The percentage of the project’s annual electricity consumption supplied by the solar photovoltaic system is calculated using the formula below:

$$Percentage\ PV\ Contribution = \frac{Electrical\ Energy\ Generated\ by\ the\ Photovoltaic\ System}{Annual\ Electrial\ Energy\ Consumed\ \ by\ the\ Building} * 100$$

The electrical energy generated by the photovoltaic system can be determined using calculation tools or software simulation performed by a qualified professional. The annual electrical energy consumed by the building can also be determined through building energy modeling performed by a qualified professional. It can be also estimated by using energy consumption benchmarking of similar buildings considering the building usage type and the climate zone.

For initial estimation, the potential electrical energy generated by a photovoltaic system can be calculated using the formula below:

$$E_{PV} = \frac{N_P * W_P * PV_{OUT}}{1000}$$

Where:

- E_{PV} = The energy generated by a photovoltaic system (kWh)
- N_p = The number of photovoltaic panels
- W_P = The photovoltaic module peak power (Watts)
- PV_{out} = The photovoltaic power potential (kWh/kW$_p$) – can be determined from the "Photovoltaic Power Potential in Lebanon" map.

E_{PV} presents a simple and quick method for estimating the potential electrical energy which can be produced by the photovoltaic system. However, the actual energy production of the proposed system will vary depending on several factors including

- The system type (On-grid or Off-grid)
- The module's efficiency
- The panels' tilt and orientation
- The weather conditions
- The shading effects
- The system losses

The photovoltaic power potential (PV_{OUT}) map provides a summary of the estimated solar photovoltaic (PV) power generation potential. It represents the long-term average of yearly/daily potential electricity production from a 1 kW-peak grid-connected solar photovoltaic (PV) power plant.

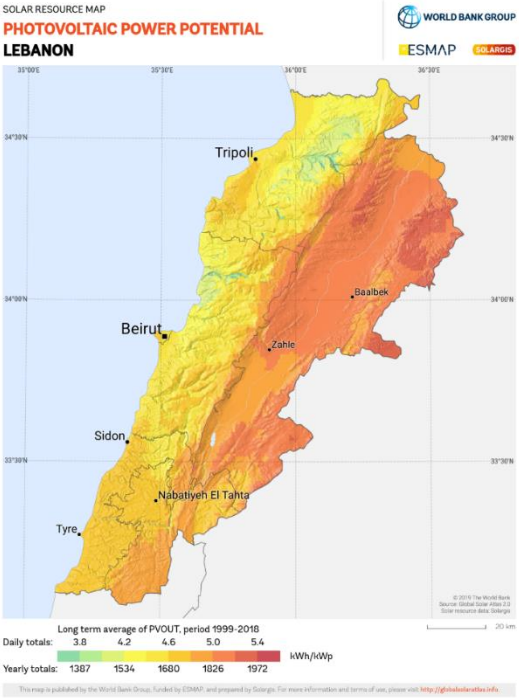


Figure 11.7.1-1. Photovoltaic Power Potential Map of Lebanon

Wind Power

Wind turbines convert wind energy into electrical energy. The main components of wind turbines include the following:

- A rotor (variable or fixed pitch blades)
- A gearbox
- A control and protection system
- A tower

- A generator

There are two main types of wind turbines:

A. A Horizontal Axis Wind Turbine (HAWT) is the most common type of wind turbine in use today. These turbines have a horizontal rotor shaft and an electrical generator which are both located at the top of a tower. The axis of rotation is parallel to the ground and these HAWTs usually consist of two or three blades.
B. A Vertical Axis Wind Turbine (VAWT) is designed with a vertical rotor shaft, a generator and a gearbox which is placed at the bottom of the turbine. These have a uniquely shaped rotor blade which is designed to harvest the power of the wind regardless of the direction it is blowing in.

The amount of electrical energy generated by the wind turbine depends mainly on the wind speed and the placement of the turbine. In order for a wind turbine to be effective, it needs to be positioned in an area where it can access a relatively consistent flow of the wind. When obstructed by buildings, hills, or trees, the wind flow is altered or hindered, which results in what is known as roughness, and which does not allow the wind turbines to perform at their best.

Wind energy is intermittent; therefore, energy storage is necessary to allow on demand supply in times of lower turbine output. The power output of a wind turbine varies with the wind speed, and each turbine has a specific power curve.

The percentage of the project’s annual electricity consumption, which is supplied by on-site wind turbines, is calculated using the formula below:

$$Percentage\ Wind\ Turbine\ Contribution = \frac{Electrical\ Energy\ Generated\ by\ the\ Wind\ Turbines}{Annual\ Electrial\ Energy\ Consumed\ \ by\ the\ Building} * 100$$

The electrical energy generated by the wind turbines can be determined using calculation tools or software simulations performed by a qualified professional. The annual electrical energy consumed by the building can also be determined using building energy modeling performed by a qualified professional. It can be estimated by using energy consumption benchmarking of similar buildings considering the building usage type and the climate zone.

Monthly and long-term mean wind speeds at 10 m above ground level have been collected from Météo Liban, at their meteorological stations located in various regions across Lebanon. The tables hereunder show the collected measurements as per The National Wind Atlas of Lebanon, CEDRO, 2011.

Table 11.7.1-2. Monthly and Long-Term Mean Wind Speeds (m/s) in Various Regions in Lebanon

	Beirut Airport	Beirut Golf	Tripoli	Sour	Klaiaat Akkar	Abdé	Les Cèdres	Dahr-el-Baidar
January	3.4	3.0	1.9	3.3	7.2	2.4	4.4	6.0
February	3.7	3.3	2.4	3.4	6.1	2.9	4.6	6.1
March	3.5	3.0	2.3	3.2	5.1	3.0	4.2	6.1
April	3.1	3.1	2.4	3.1	4.5	2.9	4.5	5.9
May	3.2	3.0	2.2	2.9	3.5	2.5	4.1	5.5
June	3.2	3.0	2.1	3.0	3.3	2.6	3.5	5.3
July	3.4	3.1	2.3	3.1	4.2	2.7	3.3	5.8
August	3.0	2.7	2.0	2.8	2.5	2.4	3.1	5.5
September	2.8	2.5	1.9	2.9	2.8	2.3	3.3	5.0
October	3.0	2.3	1.6	2.6	1.8	2.3	3.9	4.3
November	2.7	2.2	1.6	2.8	3.9	2.5	3.7	4.3
December	3.6	2.5	1.8	2.9	5.4	2.4	4.0	4.9
Data period (years)	8.8	11.1	11.2	8.8	1.6	11.0	9.6	7.4
Long-term mean wind speed	3.2	2.8	2.0	3.0	4.2	2.6	3.9	5.4

	Bayssour	Zahlé	Rayak	Qaraoun	Faqra	Hermel	Marjayoun	Zahrani
January	4.2	2.6	3.3	4.0	2.7	3.2	5.9	4.0
February	4.0	2.7	3.7	4.2	3.2	3.2	8.1	4.6
March	4.0	2.7	3.8	4.2	2.9	3.5	7.3	4.3
April	3.6	2.9	4.1	4.0	2.5	3.4	-1	4.1
May	3.3	2.7	3.7	3.8	2.4	3.3	-1	4.2
June	3.2	2.9	3.8	3.6	1.8	3.1	8.9	3.7
July	3.0	2.9	3.7	3.6	1.7	3.8	9.1	3.7
August	2.6	2.6	3.5	3.4	1.6	2.8	-1	3.6
September	3.0	2.4	3.4	3.5	1.8	2.8	-1	3.7
October	3.2	2.0	3.0	3.7	2.4	2.5	7.4	3.9
November	3.4	1.9	3.1	3.7	2.6	2.1	6.8	4.0
December	3.6	2.5	3.6	4.0	3.1	2.9	6.4	4.1
Data period (years)	7.7	9.5	9.3	2.1	1.1	1.4	0.7	4.3
Long-term mean wind speed	3.4	2.6	3.6	3.8	2.4	3.1	-2	4.0

Biomass

Biomass is organic material which is generated or produced by living or once-living organisms such as plants and animals. It is considered a renewable source of energy and a more sustainable alternative for fossil fuels. Biomass can be either burned directly for heat, or converted directly for electricity, or processed indirectly into liquid biofuels or biogas, which can be burned as fuel. The term biofuel refers to liquid or gaseous fuels which are predominantly produced from biomass. Examples of burned biomass and their uses for energy:

- Biomass: Wood and wood processing wastes

  Use : To burn it in order to heat buildings, to produce process heat in industry, and to generate electricity
- Biomass: Agricultural crops and waste materials

  Use : To burn it as a fuel or to convert it to liquid biofuels (i.e., ethanol and biodiesel)

- Biomass: Food, yard, and wood waste in garbage
  Use : To burn it in order to generate electricity in waste-to-energy power plants or convert it to biogas in landfills (i.e., methane)
  Biomass: Animal manure and human sewage
  Use : To burn it in order to convert it to biogas, which can be burned as a fuel

Whether burning fossil fuels or burning biomass, the burning process releases carbon dioxide (CO_2), which is a greenhouse gas contributing to global warming. However, while growing, the sources of biomass energy (i.e., plants and trees) can capture almost the same amount of carbon dioxide through photosynthesis as the amount which is released when biomass is burned. Consequently, biomass is considered a carbon-neutral energy source. In all cases, biomass systems especially waste-to-energy plants must be monitored and controlled in order to minimize emissions by capturing air pollutants.

The percentage contribution of the biomass system can be calculated using the formula below:

$$Percentage\ Biomass\ System\ Contribution = \frac{Energy\ Supplied\ by\ Biomass\ System}{Total\ Annual\ Energy} * 100$$

The calculation of the energy supplied by the biomass system and the total annual energy should be determined using the calculation tools or software simulation, and should be performed by a qualified professional.

Installing the biomass boilers such as wood pellet boilers as the main heating source of the project makes it compliant with this criterion.

Other Renewable Energy Sources

The other renewable energy sources can be either onsite or offsite systems as described below.

Onsite systems are defined as renewable energy generated within the project site boundary from alternative sources which were not mentioned previously under this criterion. Potential onsite renewable energy technologies include

- Geothermal energy system
- Wave/Tidal/Hydro energy systems
- Any other renewable energy technology shall be subject for approval by the ARZ reviewers

Offsite systems are defined as renewable energy generated outside of the project site boundary. These systems can be either constructed by the project owner offsite to serve other facilities or the project can be supplied by an offsite renewable energy system through a purchase agreement.

Eligible renewable technologies include, but are not limited to,

- Solar electricity systems
- Solar thermal systems
- Wind energy systems
- Geothermal energy systems
- Wave/Tidal/Hydro energy systems
- Any other renewable energy technology shall be subject for approval by the ARZ reviewers.

The percentage of the project’s annual energy consumption supplied by onsite and/or offsite renewable energy sources is calculated using the formula below:

$$Percentage\ Renewable\ Energy = \frac{Energy\ Generated\ by\ Renewable\ Energy\ Sources}{Annual\ Energy\ Consumed\ by\ the\ Building} * 100$$

The score for this criterion is determined based on the percentage contribution from the renewable energy sources. The minimum requirements are as follows:

- The percentage contribution from renewable energy sources should be higher than the annual building energy consumption by 1% in order to be eligible for this criterion.

11.7.1.5 Special Requirements

None

11.7.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.7.1-3. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Design drawings	• The Design Drawings should show either the layout of the proposed renewable energy system(s) or the connection to the offsite system.
Specifications	• The Specifications should show all the components of the proposed renewable energy systems.

Submittal Name	Submittal Description
Calculations of the Renewable Energy Supply	• The Calculations should include all the assumptions, the formulas, and the references used to determine the annual energy supplied by the onsite and/or offsite renewable energy systems.
Renewable Energy Purchase Agreement	• The draft copy of the renewable energy purchase agreement (for offsite systems) should be included.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show either the layout of the proposed renewable energy system(s) or the connection to the offsite system.
Manufacturer Datasheets	• The Manufacturer Technical Datasheets should include all the components of the proposed renewable energy systems.
Calculation of the Renewable Energy Supply	• The Calculations should include all the assumptions, the formulas, and the references used to determine the annual energy supplied by the onsite and/or offsite renewable energy systems.
Renewable Energy Purchase Agreement	• The signed copy of the final renewable energy purchase agreement (for offsite systems) should be included.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-built Drawings	• The As-built Drawings should show either the layout of the proposed renewable energy systems or the connection to the offsite system.
Manufacturer Datasheets or Nameplate Photos	• The Manufacturer Technical Datasheets or Nameplate Photos should include all the components of the proposed renewable energy systems.
Energy Metering/Billing Data	• This should include the following data combined: ○ The annual building energy consumption data of all the energy sources ○ The annual energy generation data provided by each renewable energy source.

Submittal Name	Submittal Description
Calculation of the Renewable Energy Supply	- The Calculations should include all the assumptions, the formulas, and the references used to determine the annual energy supplied by the onsite and/or offsite renewable energy systems.
Renewable Energy Purchase Agreement	- The signed copy of the renewable energy purchase agreement (for offsite systems) should be included.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.7.1.7 Score Allocation

The score for this criterion is determined based on the percentage energy contribution from renewable energy sources. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1$$

Where

- F_1 is calculated using the following formula:
  If 1% ≤ Energy contribution from renewable energy sources ≤ 50%,
  $$F_1 = 0.5 + 0.5 * \frac{(\text{Energy Contribution from Renewable Energy Sources } - 0.01)}{0.49}$$
  If energy contribution from renewable energy sources > 50%, $F_1 = 1$
  If energy contribution from renewable energy sources < 1%, $F_1 = 0$

A project earns a score of 50% if the energy contribution from renewable energy sources is equal to 1, and earns a score of 100% if the energy contribution from renewable energy sources is higher than 50%.

11.8 Family: Management and Operations

11.8.1 En-8.1 Energy Management Policy

11.8.1.1 Criterion Reference and Title

En-8.1: Energy Management Policy

11.8.1.2 Criterion Type

Optional

11.8.1.3 Intent

To implement energy saving measures, spread awareness, and continually monitor, control, and reduce the energy consumption at the Facility.

11.8.1.4 General Requirements

Energy Management Policy

Develop an Energy Management Policy, which demonstrates that the top management is committed to (1) reduce the energy consumption in the Facility and to (2) spread awareness of energy conservation. The Policy shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner's Association signatory (Residential Sector).
The Energy Management Policy shall comprise a Mission Statement, in which the top management shall commit to energy-saving. As to the Applicant, he or she, shall be expected to

- Spread awareness among all occupants
- Set up an Energy Management Plan
- Have a nominated Energy Management Champion who shall be responsible for achieving the targeted energy savings as well as other energy conservation initiatives by implementing the Energy Management Plan.
- Require the measurement of Key Performance Indicators (KPIs) to evaluate and validate that the desired savings are achieved.

The Policy shall have the following sections or attachments:

Mission Statement

Develop a mission statement which includes measurable initiatives to demonstrate a commitment to energy management. Measurable initiatives could be (1) to improve the energy quality at the Facility or even in the community, (2) to reduce the energy consumption at the Facility or even in the community, (3) to encourage employees to maintain the same commitment at home, and (4) to lead by example.

Measurement of Key Performance Indicators (KPIs)

The Facility shall have a procedure for the monitoring of energy consumption Key Performance Indicators (KPIs). The procedure shall include (1) a methodology to monitor two or more KPIs of energy consumption and (2) different modes of use (e.g., Electricity Generators, Air Handling Units, Lighting, Water Heaters etc.) for energy management during Facility operation. Examples of these KPIs are

- Conducting a monthly and a yearly comparison month-on-month, year-on-year, month to the same month of previous years to show any decrease or increase in energy water consumption
- Making a kWh/m^2 comparison per department, space, floor, and type of use
- Benchmarking to guide the energy saving initiative, etc.

For existing buildings, the Facility shall demonstrate that the procedure is being applied through evaluation reports, which indicate the measured KPIs, the frequency of the measurement and the evaluation, and the resulting corrective actions taken.

Nominated Energy Management Champion

The Facility shall have a nominated Energy Management Champion to execute the energy management initiatives.

- The Energy Management Champion is either an employee of the Facility, a resident of the Facility (Residential Sector) or, otherwise, a subcontractor.
- He or She should report to the head of the organization or the Owners' Association (Residential Sector).
- He or She can be either a dedicated manager or officer, or a staff member who takes on this role in addition to other roles in the Facility.
- The job requirements should include at the minimum the following tasks:
    - Enforce the Energy Management Policy
    - Measure KPIs and achieve the energy saving targets
    - Raise awareness about energy conservation
    - Track energy consumption
    - Ensure the maintenance of the applied systems
    - Ensure the execution of the Applicant's initiatives as indicated in the Mission Statement.

- The Energy Management Champion shall be a qualified individual or entity, who is certified in energy conservation or in Facility management from an industry recognized certification body, or who holds a degree in engineering with a minimum of 3 years of experience in energy management or Facility management.

Energy-Saving Targets

The Facility shall have measurable energy-saving targets and a time frame by which to have them achieved. These targets shall be approved by the head of the organization, such as the CEO, the General Manager, or the Owner's Association signatory (Residential Sector).

- These targets shall be documented as an initiative. It shall be the Energy Management Champion's responsibility to share them with the occupants and to achieve them. An example of a target is the Champion's commitment to reach an energy reduction of "X%" year-on-year or an energy reduction of "X%" by the end of year "Y".

For Exiting Buildings, the Facility must either have (1) an evaluation report, which demonstrates the achievement of these targets through energy consumption records, or (2) Key Performance Indicators (KPIs), which prove that the targets are on track. The KPIs expose what measures have been implemented so far and what energy consumption reduction has been achieved as a result to these measures.

Energy Management Plan/Policy

The energy management targets become achievable through the implementation of a number of tasks within a plan. The Facility shall develop an energy management project plan indicating the milestones to be achieved, and the associated budgets to achieve them (if required).

For Existing Buildings, the Facility shall demonstrate that one or more of these milestones was/were achieved.

This policy could be part of another policy, such as a Safety, Health and Environment policy, or a Social Responsibility policy, etc.

11.8.1.5 Special Requirements

None

11.8.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.8.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Energy Management Policy	• A simple outline should be submitted showing the scope of the Energy Management policy, which includes one or more of the following: ○ The Mission Statement ○ The proposed list of KPIs ○ The job description which details the required tasks and the minimum qualifications of the Energy Management Champion ○ The outline of the Energy Management Plan
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Energy Management Policy	• The Energy Management Policy should include one or more of the following: ○ The Mission Statement ○ The procedure for the monitoring of energy consumption KPIs ○ The job description of the Energy Management Champion ○ The commitment to an energy saving target ○ The energy management project plan with the milestones to be achieved and the associated budgets to have them achieved, if required.
Name and Qualifications of the Energy Management Champion	• The name and the qualifications of the Energy Management Champion should be provided.
Existing Building	

Submittal Name	Submittal Description
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Energy Management Policy	• The Energy Management Policy should include one or more of the following: ○ The Mission Statement ○ The procedure for the monitoring of energy consumption KPIs ○ The job description of the Energy Management Champion ○ The commitment to an energy saving target ○ The energy management project plan with the milestones to be achieved and the associated budgets to have them achieved, if required.
Evaluation Reports of Targets	• The Evaluation Reports should include (1) the status of the targets indicated in the Mission Statement, (2) the measures taken, and (3) the achievement percentage of each target.
Evaluation Reports of Energy Consumption KPIs	• The Evaluation Reports of the energy consumption KPIs should indicate (1) the value of the KPIs, (3) the frequency of the measurement, and (3) the result of the evaluation.
Name and Qualifications of the Energy Management Champion	• The name and the qualifications of the Energy Management Champion should be provided
Evaluation Report of Energy Saving Target	• The Evaluation Report of the energy saving target should either demonstrate the achievement of this target, or provide KPIs, which prove that the target is on track.
Current Energy Management Plan	• The Current Energy Management Project Plan should indicate the milestones to be achieved, and the associated budgets to have them achieved, if required. • The Current Energy Management Project Plan should also demonstrate that one or more of these milestones has/have been achieved.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.8.1.7 Score Allocation

The score for this criterion is determined based on the aforementioned parameters, which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 11.8.1-2. Factors and Weight factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Does the Facility have an Energy Management Policy?	1	Yes / No	1 / 0	2
If yes, does the Policy include a Mission Statement with targets to be met?	2	Yes / No	1 / 0	2
If yes, does the Policy request the measurement of KPIs?	3	Yes / No	1 / 0	3
Does the Facility have a nominated Energy Management Officer/ Champion?	4	Yes / No	1 / 0	3
Does the Facility have a measurable energy saving target, and a time frame within which it should be achieved?	5	Yes / No	1 / 0	5
Did the facility develop an Energy Management Plan to achieve the required energy -saving target?	6	Yes / No	1 / 0	5

In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{6}(F_i * WF_i)}{\sum_{i=1}^{6} WF_i}\right]$$

A project earns a score of 100% by complying with each of the above requirements.

11.8.2 En-8.2: Energy Conservation Awareness

11.8.2.1 Criterion Reference and Title

En-8.2: Energy Conservation Awareness

11.8.2.2 Criterion Type

Optional

11.8.2.3 Intent

To improve Occupant engagement and participation in reducing the Facility's energy consumption.

11.8.2.4 General Requirements

- Carry out energy conservation awareness campaigns such that the objectives below are achieved:
    - The Energy Management Policy is well-communicated to all occupants through gatherings or workshops.
    - The achievements of key energy-saving targets are shared with occupants.
    - An energy conservation training is offered periodically to all occupants.
    - Informative e-mails, banners, or labels are circulated / posted in the Facility.
    - A system to capture and reward successes is implemented to retain Occupant engagement.
- Allocate a budget for energy conservation awareness campaigns.
- Capture Occupant feedback on how to save energy and reduce energy costs.

Energy Conservation Awareness Campaigns

The campaigns shall be led and delivered by a certified green building professional or by an energy management professional with a minimum of 8 years of experience in energy or Facility management.

For New Buildings in the Construction Phase, at least one campaign shall be completed before certification. The minimum required attendees shall be, at the minimum, the managers at the Facility and the maintenance team.

For Existing Buildings, at least one campaign shall be completed before the certification. The attendees shall be, at the minimum, the managers of the Facility, the maintenance team, and the occupants who shall be invited. The Facility shall have planned refresher campaigns every other year.

The energy-saving achievements shall be shared periodically with occupants.

Trainings should be provided either by a certified green building professional or by an energy conservation professional, who has a minimum of 8 years of experience in energy management or Facility management.

The training shall cover at a minimum the following areas:

- An introduction to energy conservation: country challenges, benefits, etc.
- The energy sources and the energy quality of the Facility
- The energy conservation at the Facility: Implemented measures and planned measures
- The energy conservation behaviors / methods to save energy.

The Facility shall plan and share informative materials in the form of e-mails, banners, labels, etc., to raise energy conservation awareness. Such informative material shall be circulated at least quarterly.

A system to capture and reward successes shall be implemented to retain Occupant engagement, and to recognize occupants who are actively supporting, implementing, or contributing towards the energy management initiatives.

Demonstrate the above for three consecutive years, starting no later than the date of applying for certification. These could be three post-certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive.

Awareness Budget

The Facility shall have an approved five-year budget for energy management awareness campaigns. The approved budget should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.

Occupants' Feedback

The Facility shall circulate periodic questionnaires to seek feedback from all occupants regarding the current energy conservation measures, the implementation challenges thereof, and the possible opportunities to improve energy conservation.

The Facility shall encourage Occupant feedback at any time. Suggestion boxes and/or a dedicated email address shall be allocated to collect feedback and suggestions concerning energy conservation, and other matters pertaining to sustainability.

New Building

Provide a commitment to submit necessary records for three consecutive years, starting no later than the date of applying for certification.

Existing Building

Demonstrate this for three consecutive years, starting no later than the date of applying for certification. These could be three post-certification years, the past three years in the case of existing buildings, if available, or any combination of past and future years provided they are consecutive. Provide the number of occupants who shared their feedback in the past three consecutive years.

For Existing Buildings, the Facility will achieve a score based on the level of the occupants' participation. This measures the involvement of the occupants in energy conservation, and reflects the effect of the efforts of the Facility in fostering energy management awareness among its occupants.

11.8.2.5 Special Requirements

None.

11.8.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.8.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	

Submittal Name	Submittal Description
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas for Energy Conservation Awareness Campaigns	• The agendas for the planned gatherings, meetings, or workshops on energy conservation should be provided.
Outline of Energy Conservation Training	• The outline of the energy conservation training should be provided
Informative Materials	• The planned informative materials, which will be used to raise energy conservation awareness, should be provided.
Outline of the Incentive System	• The outline of the incentive system and the reward systems pertaining to the Human Resources procedures should be provided.
Five-year Budget Plan for Awareness Campaigns	• The five-year plan for energy conservation awareness campaigns should enclose a list of the planned events, and the total budget per annum.
Outline of Questionnaires for Energy Conservation	• An outline of the questionnaires, which solicit the occupants' feedback on the current energy conservation measures, challenges and opportunities, should be provided.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas for Energy Conservation Awareness Campaigns	• The agendas for the planned gatherings, meetings, or workshops on energy conservation should be provided as well as the name and the qualifications of the qualified professional who led the campaign.
Attendance Sheets of Energy Conservation Awareness Campaigns	• The attendance sheets of the energy conservation awareness campaigns should list all the managers and all the members of the maintenance team, who attended and when.
The Facility Organization Chart	• The organization chart of the Facility or of the Owners' Association should be submitted.
Agendas for Gatherings to Share Achievements	• Agendas for gatherings.

Submittal Name	Submittal Description
Energy Conservation Training	- The content of the energy conservation training course and the name and the qualifications of the qualified professional, who delivered the training, should be submitted.
Attendance sheets of Energy Conservation Training	- At this phase, the energy conservation training attendance sheets should include at a minimum the Facility managers and the maintenance team.
Informative Materials	- The planned informative materials, which will be used to raise energy conservation awareness, should be provided.
Documented Incentive System	- The document which describes the incentive system should be included.
Approved Five-year Budget for Awareness Campaigns	- The approved five-year budget for energy conservation awareness campaigns should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.
Questionnaire for Energy Conservation	- The questionnaire which solicits the occupants' feedback on the current energy conservation measures, challenges and opportunities should be provided.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Agendas for Energy Conservation Awareness Campaigns	- The agendas for gatherings, meetings, or workshops related to energy conservation awareness campaigns should be provided with the name and the qualifications of the qualified professional, who led the campaign.
Attendance Sheets Energy Conservation Awareness Campaigns	- The attendance sheets of the energy management awareness campaigns should list all those who attended and when.
The Facility Organization Chart	- The organization chart of the Facility or of the Owners' Association should be submitted.
Energy Conservation Training	- The content of the energy conservation training course and the name and the qualifications of the qualified professional, who delivered the training, should be submitted.

Submittal Name	Submittal Description
Attendance sheets of Energy Conservation Training	- The attendance sheets of the energy conservation training course should include at this phase, at a minimum, the Facility Managers, the maintenance team, and 50% of the occupants.
Informative Materials	- The planned informative materials, which will be used to raise energy conservation awareness, should be provided.
Documented Incentive System	- The document which describes the incentive system should be included.
List of Recognized Occupants	- The list of occupants, who were recognized for their successes in energy conservation at the Facility in the past three years, should be provided.
Approved Five-year Budget for Awareness Campaigns	- The approved five-year budget for energy conservation awareness campaigns should enclose an associated detailed list of the planned events, a timeline indicating their occurrence and their frequency, and the required total budget per annum.
Expenditures for Awareness Campaigns for Three Consecutive Years	- The expenditures for energy conservation awareness campaigns for three consecutive years should be provided.
Questionnaire for Energy Conservation	- The questionnaire which solicits the occupants' feedback on the current energy conservation measures, challenges and opportunities should be provided.
- Occupants' Feedback	- Copies of the occupants' feedback to the questionnaire and the other suggestions which were made regarding energy conservation for the past three years should be submitted.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.8.2.7 Score Allocation

The score for this criterion is determined based on the aforementioned parameters, which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 11.8.2-2. Factors and Weight factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor “F_i”	Weight Factor “WF_i”
Is the Energy Management Policy well communicated to all occupants through gatherings or workshops?	1	Yes / No	1 / 0	1
Are achievements of key energy-saving targets shared with occupants?	2	Yes / No	1 / 0	2
Is energy conservation training offered periodically to occupants?	3	Yes / No	1 / 0	3
Are informative e-mails, banners, or labels circulated or posted in the Facility?	4	Yes / No	1 / 0	1
Is a system to capture and reward successes implemented to retain Occupant engagement?	5	Yes / No	1 / 0	3
Does the Facility allocate a budget for awareness campaigns?	6	Yes / No	1 / 0	3
Does the Facility solicit Occupant feedback regarding energy conservation?	7	Yes / No	1 / 0	3
Average number of occupants who shared their feedback (average of the past 3 years)	8	V_8	F_8	3
Total No of Occupants	9	V_9		

Where

V_8 is the average number of occupants who shared their feedback (average of the past 3 years)

$$V_8 = \left(\frac{\sum_{i=1}^{3} Number\ Of\ Occuapnts\ who\ shared\ feedback_{Year\ i}}{3} \right)$$

V_9 is the total number of occupants at the Facility

F_8 Maximum value is 1

In order to determine the criterion score, the following formula is applied:

New Building

$$Criterion\ Scoe = 100 * \left[\frac{\sum_{i=1}^{7}(F_i * WF_i)}{\sum_{i=1}^{7} WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

Existing Building

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{8}(F_i * WF_i)}{\sum_{i=1}^{8} WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements and by having shared feedback from at least 50% of the occupants on average for the past three years.

F_8 is calculated using the following formula:

$$F_8 = \left(\frac{V_8}{V_9}\right) * 2$$

11.8.3En-8.3 Energy Consumption Tracking

11.8.3.1 Criterion Reference and Title

En-8.3: Energy Consumption Tracking

11.8.3.2 Criterion Type

Optional

11.8.3.3 Intent

To actively measure and reduce energy consumption.

11.8.3.4 General Requirements

A basic management adage says: "If you can't measure it, you can't improve it".

Monthly Energy Records (Pre-Requisite)

For LGBC benchmarking purposes, and with the Applicant's confidentiality fully preserved, LGBC requests the Applicant to commit to share the Facility's monthly energy consumption details on a yearly basis during the validity period of the ARZ certificate.

To maintain the certification of the Facility as per the LGBC template, the Applicant shall commit to share the following data with LGBC:

1- Monthly energy consumption data
2- Monthly energy main meter readings
3- Monthly main submeter readings.

The Applicant shall submit a signed declaration of this commitment as per the LGBC template.

The following parameters apply to Existing Buildings only

The Facility should calculate the targeted value of the total energy consumption (based on the current systems and usage) through one of the following methods:

- An energy audit
- An energy consumption model
- A suitable benchmark.

Energy Audit

A third-party energy audit shall be performed. This parameter is described under En-9.3 Energy Auditing (Existing Building).

Energy Consumption Model

An energy consumption model shall be performed by a qualified third-party energy modeling expert. The modeling must provide the expected annual energy consumption of the Facility. The model shall comply with the following requirements:

- The third-party shall have a minimum of five years of experience in energy modeling.
- The software in use shall be an international reference in energy modeling.
- The model shall not be more than two years old.
- No major changes in the Facility construction or use have been implemented since the model was done.

Energy Saving Benchmark

In the absence of an Energy audit or an energy model, a suitable benchmark for the total energy consumption of the Facility shall be determined. The benchmark shall be from a published source, and adequately adjusted to the Facility characteristics, which comprise, but are not limited to: the Facility condition, the installed systems, the mode and the hours of operation, the occupancy and the location. The benchmark shall be carried out by a third-party energy conservation professional, who has a minimum of 8 years of experience in energy management or Facility management. Note that the third-party energy conservation professional report shall not be more than one year old.

Monthly Electricity Consumption

The Facility must have grid electricity consumption meter records for all of its energy sources either for the past three consecutive years of electricity consumption, or for the age of the Facility. Whichever record shows lower electricity consumption will be considered.

Provide the consumption records in the following format:

Consumption Year	**Consumption Period**		**Consumption (kWh)**
	Start	End	

For each electricity meter reading provide the corresponding year and period. Where

- Year 3 is the most recent year

- Year 2 is the previous year
- Year 1 is three years prior to the record submittal
- The period start date is the first day of the month
- The period end date is the last day of the month.

Emergency Power Source

The Facility may have other energy resources, such as an emergency power source, which can be either an onsite generator or another non-grid emergency power source, and which is used as a power backup for the electricity.

In case the Facility has recourse to one or more emergency power source(s), it must keep monthly emergency electricity consumption records of each one.

Provide the consumption records in the following format:

Consumption Year	**Consumption Period**		**Consumption (kWh)**
	Start	End	

For each electricity consumption amount, provide the corresponding year and period. Where

- Year 3 is the most recent year
- Year 2 is the previous year
- Year 1 is three years prior to the record submittal
- The period start date is the first day of the month
- The period end date is the last day of the month.

Emergency Diesel Generator

During power outage, the Facility may have an emergency onsite diesel generator to ensure power continuity.

In case the Facility has an onsite emergency diesel generator, it must keep monthly fuel consumption records of this emergency power source.

Provide the consumption records in the following format:

	Consumption Period	**Qty (Lit)**

Consumption Year	Start	End	

For each diesel consumption amount, provide the corresponding year and period. Where

- Year 3 is the most recent year
- Year 2 is the previous year
- Year 1 is three years prior to the record submittal
- The period start date is the first day of the month
- The period end date is the last day of the month.

Diesel Boilers

In case the Facility has diesel boilers installed, it must keep monthly records of their consumption.

Provide the consumption records in the following format:

Consumption Year	**Consumption Period**		**Qty (Lit)**
	Start	End	

For each diesel consumption amount, provide the corresponding year and period for three consecutive years. Where

- Year 3 is the most recent year
- Year 2 is the previous year
- Year 1 is three years prior to the record submittal
- The period start date is the first day of the month
- The period end date is the last day of the month.

LPG Boilers

In case the Facility has LPG boilers, it must keep monthly records of their consumption.

Provide the consumption records in the following format:

Consumption Year	Consumption Period		Qty (Kg)
	Start	End	

For each LPG consumption amount, provide the corresponding year and period. Where

- Year 3 is the most recent year
- Year 2 is the previous year
- Year 1 is three years prior to the record submittal
- The period start date is the first day of the month
- The period end date is the last day of the month.

Total Electric Energy Consumption kWh/Yr.

The total energy consumption of the 12 months prior to the date of applying for certification shall be equal to or lower than the expected total energy consumption, which is generated by one of the following methods:

- Energy Audit
- Energy Consumption Model
- Energy saving benchmark

11.8.3.5 Special Requirements

None

11.8.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.8.3-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Head of the Facility Official Declaration	• The Head of the Facility should commit to provide LGBC with the energy consumption data on an annual basis by filling out an LGBC template and officially submitting it.

Submittal Name	Submittal Description
New Building in Construction Phase	
Head of the Facility Official Declaration	• The Head of the Facility should commit to provide LGBC with the energy consumption data on an annual basis by filling out an LGBC template and officially submitting it.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Head of the Facility Official Declaration	• The Head of the Facility should commit to provide LGBC with the energy consumption data on an annual basis by filling out an LGBC template and officially submitting it.
Name and Qualifications of the Energy Modeling Expert	• The name and the qualifications of the energy modeling expert along with a portfolio of his/her previous energy modeling studies should be provided.
Name and Version of the Energy Modeling Software	• The Datasheet of the energy modeling software should be provided.
Energy modeling report	• Both the energy modeling output (including the details of the input data used) and the energy model report shall indicate the expected annual energy consumption of the Facility.
The Name of the Published Source of the Benchmark	• The full reference should include the ISBN number of the published source from which the adopted energy consumption benchmark is derived.
Name and Qualifications of the Energy Conservation Expert	• The name and the qualifications of the energy conservation expert, who provided a benchmark for the Facility, should be provided along with his/her portfolio of previous works.
The Energy Consumption Benchmark	• A detailed report of the derivation of the energy consumption benchmark should be applicable to the Facility characteristics.
Energy Invoices and Energy Meter Readings for the Past Three Years	• Copies of all the energy invoices and the energy meter readings, which have been issued by all the possible external sources providing energy supply to the Facility for the past three years.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.8.3.7 Score Allocation

The score for this criterion is determined based on the aforementioned parameters which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 11.8.3-2. Factors and Weight factors for Each Parameter

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
In order to maintain the certification, does the Applicant commit to provide LGBC with monthly (1) energy consumption data, (2) energy main meter readings, and (3) sub-main meter readings on a yearly basis as per the LGBC template?	1	Yes / No	1 / 0	
The total annual energy consumption target of the Facility as per the aforementioned energy audit report, energy model, or benchmark.		$V_{\text{Target EE}}$		
The total annual diesel consumption target of the Facility as per the aforementioned energy audit report, energy model, or benchmark is (L / Yr.)		$V_{\text{Target D}}$		
The total annual LPG consumption target of the Facility as per the aforementioned energy audit report, energy model, or benchmark is (Kg / Yr.).		$V_{\text{Target LPG}}$		

Parameter	Parameter No (i)	Status	Factor "F_i"	Weight Factor "WF_i"
Electric energy consumption of the recent year i.e., the last 12 months (kWh / Yr.)	2	$V_{\text{Recent Yr. EE}}$	F_2	WF_2
Diesel consumption of the recent year i.e., the last 12 months (L / Yr.)	3	$V_{\text{Recent Yr. D}}$	F_3	WF_3
LPG consumption of the recent year i.e., the last 12 months (Kg / Yr.)	4	$V_{\text{Recent Yr. LPG}}$	F_4	WF_4

Each of F_2 F_3 and F_4 is calculated using the following:

Table 11.8.3-3. Factors F_2, F_3 and F_4 Values

$V_{\text{Recent Yr.}}$	F_2, F_3 and F_4
$\leq$ 80% of V_{Target}	100%
= V_{Target}	50%
80% of $V_{\text{Target}} \leq V_{\text{Recent Yr.}} \leq V_{\text{Target}}$	100% ≥ F ≥ 50%
> V Target	0%

Where

$V_{\text{Recent Yr.}}$ is the consumption of electric energy, diesel or LPG for the latest year.

> Note: The recent year electric energy is the sum total of all the external electric energy sources i.e., Grid + Emergency Generators + Onsite Generators.

V_{Target} is the consumption target of the total annual electric energy, diesel or LPG of the Facility as per the aforementioned energy audit report, energy model, or benchmark

The Total Expected Energy Consumption - $E_{\text{T Target}}$

The total expected energy consumption of the Facility is calculated using the following formula:

$$E_{T\ Target} = \mathrm{V}_{\text{Target EE}} + \left(\mathrm{V}_{\text{Target D}} \times 10.55\right) + \left(\mathrm{V}_{\text{Target LPG}} \times 11\right)$$

Such that:

$$WF_2 = \frac{\mathrm{V_{Recent\ Yr.EE}}}{E_{T\ Target}}$$

$$WF_3 = \frac{\mathrm{V_{Recent\ Yr.D}}}{E_{T\ Target}}$$

$$WF_4 = \frac{\mathrm{V_{Recent\ Yr.LPG}}}{E_{T\ Target}}$$

In order to determine the criterion score, the following formula is applied for each energy source available at the Facility, or else the energy source is omitted:

$$Criterion\ Score = 100 * F_1 * \left[\frac{\sum_{i=2}^{4}(F_i * WF_i)}{\sum_{i=2}^{4} WF_i}\right]$$

The following are the pre-requisites for this criterion:

- Committing to provide the energy consumption records
- Keeping a consumption record of each energy source for Existing Buildings for at least the past year.

At least one of the following should be performed to serve as a target for the Facility or else the criterion score is zero:

  - Energy audit
  - Energy consumption model
  - Energy saving benchmark

11.8.4 En-8.4: Energy Systems Operation and Maintenance

11.8.4.1 Criterion Reference and Title

En-8.4: Energy System Operation and Maintenance

11.8.4.2 Criterion Type

Optional

11.8.4.3 Intent

To maintain the energy systems at the Facility at their optimal performance, to preserve their condition, to prolong their life, and to eliminate any early replacements.

11.8.4.4 General Requirements

Develop Operation and Maintenance manuals(O&M) and a maintenance regime for all the energy consuming and generating systems at the Facility including (if installed at the Facility) , but not limited to:

- Emergency Generators
- Panel Boards
- Dimming Systems
- Outdoor/Indoor Lighting
- Air Handling Units
- Fan Coil Units
- Variable Air Volume Units
- Air Curtains
- Exhaust Fans
- Fresh Air Fans
- Underground Parking Exhaust Fans
- Underground Parking Fresh Air Fans
- Split AC Units
- Variable Refrigerant Volume Units
- Boilers
- Chillers
- Boiler Pumps
- Expansion Tanks
- Transfer Water Pumps
- Booster Pumps
- Sump Pump
- Humidifiers
- Water Fountains
- Fridges/Freezer
- BMS
- Solar Water Heating
- Biomass
- Photovoltaic system
- Wind Power
- Chilled Water Pumps
- Condenser Water Pumps
- Cooling Towers
- Hot Water Tanks
- Hot Water Circulating Pumps

Maintenance Regime

Develop a maintenance regime for all the energy consuming and generating systems, which are installed in the Facility.

The maintenance regime development process [1] comprises three steps:

Firstly, it identifies the list of assets which constitute each system, and which will receive asset care. Secondly, it defines the Preventive Maintenance (PM) job plans for each type of asset. Thirdly, it assigns a frequency for each PM job plan.

Figure 11.8.4-1. Maintenance Regime Development Process

Preventive maintenance job plans in general fall under one of the following types of activities:

- Inspecting and identifying defects
- Cleaning, greasing, tightening
- Functional testing.

The preventive maintenance job plan shall be executed at a frequency which is equal to or lower than the list of minimum acceptable frequencies (as per the industry best practices [2]) below.

These frequencies are the minimum acceptable frequencies.

Table 11.8.4-1. Minimum Acceptable PM Frequencies

Minimum Acceptable PM Frequencies			
System	**Visual Inspections (Record Readings and Findings)**	**Cleaning, Greasing, and Tightening**	**Function Test (Eg., Safety Devices, and Controls)**
Emergency Generators	Monthly	Bimonthly	Seasonal /Yearly
Panel Boards	Every 3 Months	Yearly / Seasonal	Every 3 Years
Dimming System	Weekly	Every 6 Months	Seasonal / Yearly

Minimum Acceptable PM Frequencies

System	Visual Inspections (Record Readings and Findings)	Cleaning, Greasing, and Tightening	Function Test (Eg., Safety Devices, and Controls)
Outdoor Lighting	Weekly	Every 6 Months	
Indoor Lighting	Weekly	Seasonal / Yearly	
Air Handling Units	Monthly	Every 3 Months	Seasonal / Yearly
Fan Coil Units	Every 3 Months	Every 6 Months	Seasonal / Yearly
Variable Air Volume Units	Every 6 Months	Every 6 Months	Seasonal / Yearly
Air Curtains	Every 6 Months	Every 6 Months	Seasonal / Yearly
Exhaust Fans	Monthly	Every 6 Months	Seasonal / Yearly
Fresh Air Fans	Monthly	Every 6 Months	Seasonal / Yearly
Underground Parking Exhaust Fans	Monthly	Every 6 Months	Seasonal / Yearly
Underground Parking Fresh Air Fans	Monthly	Every 6 Months	Seasonal / Yearly
Split AC Units	Every 3 Months	Every 3 Months	Seasonal / Yearly
Variable Refrigerant Volume Units	Every 3 Months	Every 3 Months	Seasonal / Yearly
Boilers	Monthly	Every 3 Months	Seasonal / Yearly
Chillers	Monthly	Every 3 Months	Seasonal / Yearly
Boiler Pumps	Monthly	Every 6 Months	Seasonal / Yearly
Chilled Water Pumps	Monthly	Every 6 Months	Seasonal / Yearly
Condenser Water Pumps	Monthly	Every 6 Months	Seasonal / Yearly
Cooling Towers	Monthly	Every 3 Months	Seasonal / Yearly
Hot Water Tanks	Every 6 Months	Yearly / Seasonal	Seasonal / Yearly
Hot Water Circulating Pumps	Monthly	Every 6 Months	Seasonal / Yearly
Expansion Tanks	Every 6 Months	Yearly / Seasonal	Seasonal / Yearly
Transfer Water Pumps	Monthly	Every 6 Months	Seasonal / Yearly
Booster Pumps	Monthly	Every 6 Months	Seasonal / Yearly
Sump Pump	Monthly	Yearly / Seasonal	Seasonal / Yearly
Humidifiers	Every 6 Months	Yearly / Seasonal	Seasonal / Yearly
Water Fountains	Every 3 Months	Every 3 Months	Seasonal / Yearly
Fridges / Freezers	Every 3 Months	Every 3 Months	Seasonal / Yearly
BMS	Weekly	Yearly / Seasonal	Seasonal / Yearly
Solar Water Heating	Monthly	Every 3 Months	Seasonal / Yearly
Biomass	Monthly	Every 3 Months	Seasonal / Yearly
Photovoltaic	Monthly	Every 3 Months	Seasonal / Yearly
Wind Power	Monthly	Every 3 Months	Seasonal / Yearly

The Operation and Maintenance (O&M) manuals shall include all applicable energy consuming and generating systems and define the maintenance regime with the frequencies of each job plan.

Demonstrate that the preventive maintenance job plans were implemented:

New Building
Provide a commitment to submit necessary records to LGBC for three consecutive years, starting no later than the date of applying for certification.
Existing Building
Provide LGBC with necessary records for three consecutive years. These could be three post-certification years, the past three years, if available, or any combination of past and future years provided they are consecutive.
In case of a post-certification record submittal, a prior binding commitment to LGBC is required.

For Existing Buildings, conduct a condition assessment of all the energy consuming and energy generating systems and equipment at the Facility, by a qualified individual or entity who is certified in Facility management from an industry recognized certification body, or who holds a degree in engineering, and has a minimum of 8 years of experience in Facility management. The condition survey shall follow the guidelines of CIBSE Guide M chapter 14 of the 2014 edition. [5]
Operation and Maintenance Manuals

Develop Operation and Maintenance (O&M) manuals for each of the aforementioned systems which are installed at the Facility.

The (O&M) manuals are pivotal to enable the operation and maintenance team to provide the needed preventive, corrective, and predictive maintenance to the installed systems. Their purpose is to consolidate and explain what systems are installed, and how they are configured, operated, and maintained. [3]

The (O&M) manuals shall include at a minimum the following data: [3]

- As-built drawings and approved material submittals
- Original Equipment Manufacturer (OEM) engineering manuals, Operation and Maintenance (O&M) manuals, Spare Parts manuals

- Installation requirements
- Start-up requirements
- Site configuration procedures (How the systems must be configured in normal operation.)
- Standard Operating Procedures (SOPs)
- Emergency Operating Procedures (EOPs) (This is to be applied during a breakdown, or other abnormal event, in order to restore the operation to as close as could be to the design condition, and to stop any further deterioration of the systems)
- Maintenance regime as defined earlier
- Studies (e.g., electrical, mechanical, circuit breaker)
- Commissioning reports
- Warranty certificates (including any support agreements)
- Systems' sequence of operation
- Recommended spare parts inventory items
- A process to continuously update the Operation and Maintenance (O&M) manuals as changes are introduced to the system configurations, the settings, etc., or after component replacements, repairs, etc.

The aforementioned requirements for (O&M) manuals are common among the following criteria:
Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4

Computer-Aided Facility Management System (CAFM)

Implement a Computer-Aided Facility Management system to direct, control, and document the maintenance activities at the Facility.

A Computer-Aided Facility Management system stores the Facility asset register, the maintenance activities, the utility meter readings, the historical breakdowns and repairs, and the upgrades and replacements. Therefore, the CAFM forms a management information system for the facility. [1]

The CAFM shall have the following minimum requirements [1]:

- Asset Registry (The asset registry stores information, such as the main features, the nameplate information, the specifications, the date in service, the warranty details, the vendors, etc.)

- Work orders (The work orders include planning jobs, allocating personnel, booking needed materials and tools, and tracking costs)
- Preventive Maintenance (The Preventive Maintenance (PM) is about scheduling and automatically issuing work orders once the period from last completion date is reached)
- Emergency work orders
- Service requests
- Inventory control
- Reporting.

The aforementioned requirements for CAFM are common among the following criteria:
Si-4.5, Si-4.6, Wa-5.5, We-3.1, En-8.4

11.8.4.5 Special Requirements

None

11.8.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.8.4-2. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Maintenance Requirements	• The tender documents should include a section which specifies the maintenance requirements of the energy systems and the minimum required frequencies.
Operation and Maintenance (O&M) Manuals Requirements	• The requirements in the Operation and Maintenance (O&M) manuals shall be part of the tender documents.

Submittal Name	Submittal Description
CAFM Requirements	• The tender documents shall include a section showing that the Computer-Aided Facility Management (CAFM) requirements meet the minimum features.
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Asset List	• The comprehensive list of assets per energy system, which are installed at the Facility, should be provided.
Preventive Maintenance Job Plans and Frequencies	• The Preventive Maintenance (PM) job plans of the energy systems and their frequencies should be provided. A commitment to provide the executed job plans signed and dated by the inspector for the three post certification years.
Job Plans	• A commitment to provide these job plans for the balance of the required three years should be made.
Operation and Maintenance (O&M) Manuals	• The Operation and Maintenance (O&M) manuals should be provided for each energy system installed at the Facility and meeting the minimum requirements.
Computer-Aided Facility Management (CAFM) Information	• The Computer-Aided Facility Management (CAFM) shall include information, such as the name, the version, and the features which satisfy the minimum requirements.
Computer-Aided Facility Management (CAFM) Generated Documents	• The Computer-Aided Facility Management (CAFM) shall include the generated documents for the asset registry, the work order list, the inventory items list, the PM job plans and their frequencies.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Asset List	• The comprehensive list of assets per energy system, which are installed at the Facility, should be provided.
Preventive Maintenance Job Plans and Frequencies	• The Preventive Maintenance (PM) job plans of the energy systems and their frequencies should be provided.

Job Plans	• The executed Preventive Maintenance (PM) job plans of the energy systems should be signed and dated by the inspector. A commitment to provide these job plans for the balance of the required three years is necessary
Operation and Maintenance (O&M) Manuals	• The Operation and Maintenance (O&M) manuals should be provided for each energy system installed at the Facility and meeting the minimum requirements.
Computer-Aided Facility Management (CAFM)Information	• The Computer-Aided Facility Management (CAFM) shall include information, such as the name, the version, and the features which satisfy the minimum requirements.
Computer-Aided Facility Management (CAFM) Generated Documents	• The Computer-Aided Facility Management (CAFM) shall include the generated documents for the asset registry, the work order list, the inventory items list, the PM job plans and their frequencies.
Condition Survey of All Energy Consuming and Energy Generating Systems and Equipment	• A Condition Survey of all the energy consuming and energy generating systems and equipment as per the CIBSE Guide M should be carried out and submitted.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.8.4.7 Score Allocation

The score for this criterion is determined based on the aforementioned parameters, which are tabulated in the following section. Factors and weight factors are applied to each parameter as follows:

Table 11.8.4-3. Factors and Weight factors for Each Parameter

System	Parameter No (i)	Minimum PM Frequency for All Three Parameters is Achieved	Factor “F_i”	Weight Factor “WF_i”
Emergency Generators	1	Yes / No	1 / 0	10
Panel Boards	2	Yes / No	1 / 0	3
Dimming Systems	3	Yes / No	1 / 0	5
Outdoor Lighting	4	Yes / No	1 / 0	4
Indoor Lighting	5	Yes / No	1 / 0	4
Air Handling Units	6	Yes / No	1 / 0	10
Fan Coil Units	7	Yes / No	1 / 0	5
Variable Air Volume Units	8	Yes / No	1 / 0	10
Air Curtains	9	Yes / No	1 / 0	3
Exhaust Fans	10	Yes / No	1 / 0	5
Fresh Air Fans	11	Yes / No	1 / 0	5
Underground Parking Exhaust Fans	12	Yes / No	1 / 0	5
Underground Parking Fresh Air Fans	13	Yes / No	1 / 0	5
Split AC Units	14	Yes / No	1 / 0	5
Variable Refrigerant Volume Units	15	Yes / No	1 / 0	5
Boilers	16	Yes / No	1 / 0	10
Chillers	17	Yes / No	1 / 0	10
Boiler Pumps	18	Yes / No	1 / 0	5
Chilled Water Pumps	19	Yes / No	1 / 0	7
Condenser Water Pumps	20	Yes / No	1 / 0	7
Cooling Towers	21	Yes / No	1 / 0	10
Hot Water Tanks	22	Yes / No	1 / 0	5
Hot Water Circulating Pumps	23	Yes / No	1 / 0	5
Expansion Tanks	24	Yes / No	1 / 0	3
Transfer Water Pumps	25	Yes / No	1 / 0	5
Booster Pumps	26	Yes / No	1 / 0	5
Sump Pump	27	Yes / No	1 / 0	1
Humidifiers	28	Yes / No	1 / 0	3
Water Fountains	29	Yes / No	1 / 0	5

System	Parameter No (i)	Minimum PM Frequency for All Three Parameters is Achieved	Factor "F_i"	Weight Factor "WF_i"
Fridges / Freezers	30	Yes / No	1 / 0	4
BMS	31	Yes / No	1 / 0	10
Solar Water Heating	32	Yes / No	1 / 0	7
Biomass	33	Yes / No	1 / 0	7
Photovoltaic	34	Yes / No	1 / 0	7
Wind Power	35	Yes / No	1 / 0	7

If the system is covered in the O&M manuals as described above, then $OM_i = 1$, or else $OM_i = 0$.
If the system is managed through a CAFM as described above, then $CAFM_i = 2$, or else $CAFM_i = 1$.

In order to determine the criterion score, the following formula is applied only for the systems which are installed at the Facility, or else the system is omitted:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{35}(F_i * WF_i * OM_i * CAFM_i)}{\sum_{i=1}^{35} WF_i * CAFM_i}\right]$$

A project earns a score of 100% if the minimum PM frequency for all three parameters is achieved for every system installed at the Facility. Specifically, the project would score a 100 % if the following has been achieved:

- The frequency of the Preventive Maintenance job plans is equal to or lower than the required frequencies, and
- The system details are included in the O&M manuals, which meet the aforementioned requirements.

Managing the maintenance of a system through a CAFM, will double the weight of that system and hence will increase the total score up to 100%.

11.8.5En-8.5: Energy Systems Commissioning

11.8.5.1 Criterion Reference and Title

En-8.5: Energy Systems Commissioning

11.8.5.2 Criterion Type

Optional

11.8.5.3 Intent

To ensure that the Facility is designed, constructed, and operated within a quality assurance process targeting the intended Facility functionality, efficiency, and durability. To optimize the energy performance of the Facility's energy consuming and generating systems.

11.8.5.4 General Requirements

Implement the commissioning process in compliance with criterion Si-4.9 Commissioning Management of the Site Module to all energy consuming and energy generating systems.

For New Construction

Apply the commissioning process as a minimum to the following systems where applicable at the Facility. Perform the following pre-requisites as a minimum for this criterion:

- Chilled water distribution network
  - Perform a pressure test of the full network. (New constructions)
  - Inspect the network for condensation issues.
  - Perform water balancing, and document the setting of all the balancing valves.
- Ducted air distribution
  - Perform a leak test of the ducted air distribution system.
  - Inspect the network for condensation issues.
  - Perform air balancing, and document the setting of all balancing dampers.
  - Conduct a flush out of the system before occupancy (New Buildings), or else conduct duct cleaning for systems which are five years old or more. (Existing Building)
- Chilled water plant
  - Apply the commissioning process to the water chillers and to all the plant equipment, such as cooling towers, chilled water and condenser water pumps both primary and secondary, and all plant related controls.
  - Define the optimum set points.

  - Define the sequence of operation during startup, capacity modulation, and shutdowns during weekdays, weekends and holidays.
  - Define any seasonal changes to the aforementioned set points and schedules.
- Emergency Generators
  - Apply the commissioning process to the onsite generators and to all the plant equipment, such as automatic transfer switches, distribution panel boards, remote radiators and cooling systems, fuel supply, electric intake panels from the grid, and all the related controls.
  - Define the optimum set points.
  - Define the sequence of operation during startup, capacity modulation, and shutdowns during weekdays, weekends and holidays.
  - Define any seasonal changes to the aforementioned set points and schedules.
  - Include emission measurements in the commissioning plan.
- Building Management System (BMS)
  - Identify the occupancy schedule of the different Facility spaces.
  - Define a sequence of operation for all the systems.
  - Define the optimum set points.
  - Define the sequence of operation during startup, capacity modulation, and shutdowns during weekdays, weekends and holidays.
  - Define any seasonal changes to the aforementioned set points and schedules.
  - Setup trend logs to assist in monitoring and further optimization.

Where applicable, implement the commissioning process to the systems listed hereunder in order to be in full compliance with the requirements of the Si-4.9 Commissioning Management criterion found in the Site Module:

ELECTRICAL SYSTEMS	**MECHANICAL SYSTEMS cont'd**
Emergency Generators	Boiler Pumps
Panel Boards	Chilled Water Pumps
Dimming Systems	Condenser Water Pumps
Outdoor Lighting	Cooling Towers
Indoor Lighting	Hot Water Tanks
	Hot Water Circulating Pumps
MECHANICAL SYSTEMS	Expansion Tanks
Air Handling Units	Transfer Water Pumps
Fan Coil Units	Booster Pumps
Variable Air Volume Units	Humidifiers

Air Curtains	Water Fountains
Exhaust Fans	Fridges / Freezers
Fresh Air Fans	
Underground Parking Exhaust Fans	**RENEWABLE ENERGY SYSTEMS**
Underground Parking Fresh Air Fans	Solar Water Heating
Split AC Units	Biomass
Variable Refrigerant Volume Units	Photovoltaic
Boilers	Wind Power
Chillers	

As for Existing Buildings, if any of the aforementioned systems did not undergo a commissioning process during the construction phase, implement retro-commissioning in order to be in full compliance with the requirements of the Si-4.9 Commissioning Management criterion found in the Site Module. Furthermore, implement re-commissioning for the systems which underwent a major repair or modification after the last commissioning. Examples of major repairs are main equipment replacements, distribution system modifications, change of space use, etc.

11.8.5.5 Special Requirements

None

11.8.5.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process:

Table 11.8.5-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Commissioning Authority (CxA)	• Provide the name and the qualifications of the Commissioning Authority (CxA).
Contract with the Commissioning Authority (CxA).	• The contract with the Commissioning Authority (CxA) should show the required scope.

Submittal Name	Submittal Description
Commissioned Selected Systems	The selected systems are commissioned as per Si-4.9 Commissioning Management Requirements • Owner's Project Requirements (OPR) • Scope and method of commissioning • Commissioning team • Basis of design • Design review reports (minimum at 3 stages of the design development) • Commissioning plan • Commissioning specifications
New Building in Construction Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Commissioning Authority	• Provide the name and the qualifications of the Commissioning Authority (CxA).
Contract with the CxA	• The contract with the Commissioning Authority (CxA) should show the required scope.

Submittal Name	Submittal Description
Demonstrate that the selected systems are commissioned as per Si-4.9 Commissioning Management requirements	• Owner’s Project Requirements (OPR) • Scope and method of commissioning • Commissioning team • Basis of design • Integrated commissioning (Cx) • Commissioning (Cx) schedule • Submittals’ review • Pre-installation checklists • Installation and startup checklists • Control strategy • Systems’ Operation and Maintenance (O&M) manuals • Operator training • Training attendance sheets • Commissioning Test Procedures (CxTP) • Functional Performance Testing (FPT) • (CxTP) and (FPT) reports • Issues reports (Snag List / Punch List) • Trend long • Seasonal and off-season testing • Issues reports before warranty expiry • Optimization reports • Monitoring reports
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Commissioning Authority (CxA)	• Provide the name and the qualifications of the Commissioning Authority (CxA)
Contract with the Commissioning Authority (CxA).	• The contract with the Commissioning Authority (CxA) should show the required scope.

Submittal Name	Submittal Description
Demonstrate that the selected systems are commissioned as per Si-4.9 Commissioning Management requirements	• Owner's Project Requirements (OPR) • Commissioning team • Observations of the Commissioning Authority (CxA) • Commissioning (Cx) scope and the Commissioning (Cx) plan • Individual component testing report • System testing report • Training of operation and maintenance staff • Commissioning (Cx) Report • Training of the operation and maintenance to ensure operational sustainability

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.8.5.7 Score Allocation

Provide a score allocation table for each criterion according to the level of achievement (i.e., meeting performance thresholds or implementing strategies described in the 'Requirements' sections).

Table 11.8.5-2. Factors and Weight Factors for Each Parameter

System	Parameter No (i)	The System is Commissioned	Factor "F_i"	Weight Factor "WF_i"
PREREQUISITES				
Chilled water distribution network	1	Yes / No	1 / 0	
Ducted air distribution	2	Yes / No	1 / 0	
Chilled water plant sequencing and operation	3	Yes / No	1 / 0	
Emergency Generators Load Management	4	Yes / No	1 / 0	
Building Management System (BMS)	5	Yes / No	1 / 0	
ELECTRICAL SYSTEMS				

System	Parameter No (i)	The System is Commissioned	Factor "F_i"	Weight Factor "WF_i"
Emergency Generators	6	Yes / No	1 / 0	20
Panel Boards	7	Yes / No	1 / 0	3
Dimming Systems	8	Yes / No	1 / 0	4
Outdoor Lighting	9	Yes / No	1 / 0	4
Indoor Lighting	10	Yes / No	1 / 0	4
MECHANICAL SYSTEMS				
Air Handling Units	11	Yes / No	1 / 0	20
Fan Coil Units	12	Yes / No	1 / 0	20
Variable Air Volume Units	13	Yes / No	1 / 0	20
Air Curtains	14	Yes / No	1 / 0	3
Exhaust Fans	15	Yes / No	1 / 0	20
Fresh Air Fans	16	Yes / No	1 / 0	20
Underground Parking Exhaust Fans	17	Yes / No	1 / 0	20
Underground Parking Fresh Air Fans	18	Yes / No	1 / 0	20
Split AC Units	19	Yes / No	1 / 0	20
Variable Refrigerant Volume Units	20	Yes / No	1 / 0	20
Boilers	21	Yes / No	1 / 0	20
Chillers	22	Yes / No	1 / 0	20
Boiler Pumps	23	Yes / No	1 / 0	10
Chilled Water Pumps	24	Yes / No	1 / 0	10
Condenser Water Pumps	25	Yes / No	1 / 0	10
Cooling Towers	26	Yes / No	1 / 0	20
Hot Water Tanks	27	Yes / No	1 / 0	4
Hot Water Circulating Pumps	28	Yes / No	1 / 0	10
Expansion Tanks	29	Yes / No	1 / 0	3
Transfer Water Pumps	30	Yes / No	1 / 0	10
Booster Pumps	31	Yes / No	1 / 0	10
Humidifiers	32	Yes / No	1 / 0	3
Water Fountains	33	Yes / No	1 / 0	5
Fridges / Freezers	34	Yes / No	1 / 0	4
RENEWABLE ENERGY SYSTEMS				

System	Parameter No (i)	The System is Commissioned	Factor “F_i”	Weight Factor “WF_i”
Solar Water Heating	35	Yes / No	1 / 0	20
Biomass	36	Yes / No	1 / 0	20
Photovoltaic	37	Yes / No	1 / 0	20
Wind Power	38	Yes / No	1 / 0	20

For New Building

A system is commissioned if

- It was commissioned during construction prior to handover and the commissioning process was fully compliant with the requirements of the Si-4.9 Commissioning Management.

For Exiting Building

A system is commissioned if

- It was commissioned during construction prior to handover and did not undergo a major repair or modification, Or
- It was retro-commissioned after handover and did not undergo a major repair or modification, Or
- It was re-commissioned after a major repair or modification

and the commissioning process was fully compliant with the requirements of the Si-4.9 Commissioning Management.

In order to determine the criterion score, the following formula is applied only for the systems which are installed at the Facility, or else the system is omitted:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{38}(F_i * WF_i)}{\sum_{i=1}^{38} WF_i}\right]$$

A project earns a score of 100% by complying with each of the aforementioned requirements.

11.9 Family: Bonus

11.9.1 En-9.1: Building Energy Modeling (BEM)

11.9.1.1 Criterion Reference and Title

En-9.1: Building Energy Modeling

11.9.1.2 Criterion Type

Optional

11.9.1.3 Intent

To develop an energy model which would identify and prioritize the most effective alternative efficiency measures (EMCs) in order to simulate the building energy consumption, which, eventually, would have the greatest effect on the building's energy use.

11.9.1.4 General Requirements

An energy model should be developed and reported by a qualified energy modeler expert who is certified from an industry recognized certification body, or has a minimum of three years of experience in energy modeling. The energy model is intended to support the design of high-performance buildings for new constructions, or to improve the performance of existing buildings by relying on the following measures:

modeling, simulations, calculations, discussions, identification of potential Energy Efficiency Measures (EEMS) and energy model report**.**

For new construction buildings, energy modeling should be carried out at an early stage of the design process in order to stimulate further development of the design and the construction. For existing buildings, modeling can help to evaluate and prioritize the options which reduce carbon emissions cost-effectively.

The baseline building performance must be modeled according to the building performance rating method, which is outlined in Appendix G in the ANSI/ASHRAE/IESNA Standard, 90.1–2019 by using a simulation model and minimum acceptable standards for building fabric, HVAC, lighting, power, service water heating, etc. The baseline and the proposed building performance must be developed using approved energy modeling software as per Appendix G in the ASHRAE Std. 90.1-2019 and must be approved by the ARZ review committee.

For the elements or components which cannot be modeled directly by the energy modeling software, the ARZ review committee may grant an approval for an Exceptional Calculation

Method (ECM) as outlined in Appendix G, ASHRAE Std. 90.1-2019. This method should demonstrate energy savings through a narrative explanation using both theoretical and empirical information to describe the simulation, and to provide the calculations which support the accuracy of that method.

Climate Zone and thermal requirements for building envelope

The climate zone type definitions and thermal requirements for building envelopes must be selected according to En-2.1, En-2.2 and En-2.3 ARZ criteria or as per ASHRAE std. 90.1–2019 Appendix G.
The same weather data must be used identically in both the baseline and the proposed model.

Schedules

The schedule inputs for occupancy, lighting, HVAC system, receptacle power, and service hot water consumption must be accurately defined into the model for optimal results. If the schedules are unknown, the schedules found in the ASHRAE Std. 90.1–2019 user's manual, Appendix G may be used instead. The schedules must be identical in both the baseline and the proposed cases unless documented in an exceptional calculation, or specifically allowed by the ASHRAE Std. 90.1–2019 user's manual, Appendix G.

Receptacle and process loads

Receptacle and process loads must be modeled identically in both the baseline model and the proposed model.

End-use load components

Both the baseline model and the proposed model shall include at a minimum the following end-use load component:

- Lighting (Internal and External)
- Receptacle and process loads
- Space heating
- Space cooling
- Heat rejection
- Refrigeration

- Fans
- Pumps
- Service water heating.

Building performance energy saving

The proposed building performance energy saving is defined as

$$\begin{matrix}\mathit{Percentage\ of} \\ \mathit{Energy\ Saving}\ (\%)\end{matrix} = \left(\frac{\mathit{Baseline\ Energy\ Consumption}\ - \mathit{Proposed\ Energy\ Consumption}}{\mathit{Baseline\ Energy\ Consumption}}\right) \times 100$$

The baseline and the proposed building energy consumption provided by the energy model results are in (kWh/year).

31.

Energy Modeling Report

32. An energy modeling report could be submitted with the following outline which contains at a minimum:

33.

- The basic building or facility description (location, orientation, geometry characteristics)
- The building use and surface in square meters, demographics, 3D view and aerial imaging, if available
- The description and the capabilities of the energy modeling software used
- The energy model description for both the baseline and the proposed models
- The climate zone and weather data used
- The building envelope description with the thermal characteristics as per the (En-2.1, En-2.2 and En-2.3) ARZ criteria for building envelopes, or as per the ASHRAE std. 90.1-2019 performance method for both the baseline model and the proposed model
- The HVAC system description, set points, minimum energy efficiency requirements, and fan power calculations as per the(En-3.1, En-3.2, En-3.4, En-3.5, En-3.6 and En-3.7) ARZ criteria or as per the ASHRAE std. 90.1-2019 performance method for both the baseline model and the proposed model
- The same receptacles, plug loads and process loads with the schedules for both the baseline model and the proposed model shall be modeled
- The lighting schedules, the Light Power Density (LPD) and the lighting control system defined as per the (En-5.1 and En-5.2) ARZ criteria or as per the ASHRAE std.90.1-2019 performance method for the baseline model and the proposed model with a detailed

description of the lighting system (the type of light fixtures, the number, the power, the total power)

- The service hot water system description defined as per the (En-4.1, En-4.2 and En-4.3) ARZ criteria or as per the ASHRAE std.90.1-2019 performance method for both the baseline and the proposed model
- The same occupancy description, number, schedules and heat gains for both the baseline and the proposed model
- The identification of potential measurable, achievable, and realistic conservation measures
- The sensitivity analysis and cost-benefit analysis of each energy conservation measure
- The monthly and yearly energy consumption results and the peak demand results in graphs and tables with the energy consumption breakdown of all the end-use energy systems
- The appendices (schedules, drawings, floor plans, detailed simulation results and calculations such as U-value, LPD, Fan power, etc.).

11.9.1.5 Special Requirements

None

11.9.1.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.9.1-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Qualifications	• The qualifications of the energy modeler expert should be provided.
Energy Modeling Report	• The energy modeling report should be provided as described in the general requirement section.
Energy Model Template	• The Energy Model Template shall be filled on the ARZ portal summarizing the energy model simulation.
Specifications	• The specifications of all the parameters used in the energy model such as COP, LPD, U-values, etc. should be provided.
New Building in Construction Phase	

Submittal Name	Submittal Description
Criterion Narrative	- The updated Criterion Narrative (if different from the Design Phase)
Energy Modeling Report	- The updated Energy Modeling Report (if different from the Design Phase)
Manufacturer Datasheets	- The Manufacturer Datasheets should show all the systems' parameters introduced in the energy model, such as the COP of the HVAC units, and the power of the light fixtures in use to calculate the LPD, the conductivity / resistance of the layers of the building envelope with U-values, etc.
Existing Building	
Qualifications	- The qualifications of the energy modeler expert should be provided.
Energy Modeling Report	- The energy modeling report should be provided as described in the general requirement section.
Energy Model Template	- The Energy Model Template shall be filled on the ARZ portal summarizing the energy model simulation.
Manufacturer Datasheets	- The Manufacturer Datasheets should show all the systems' parameters introduced in the energy model, such as the COP of the HVAC units, and the power of the light fixtures in use to calculate the LPD, the conductivity / resistance of the layers of the building envelope with U-values, etc.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.9.1.7 Score Allocation

The score for this criterion is determined based on the energy saving generated from the energy conservation measures adopted in the energy model. Note that the project must demonstrate 15% of energy saving in order to qualify for this criterion. The criterion score is determined according to the following table:

Table 11.9.1-2. Score Allocation

Percentage of Energy Saving (%)	Criterion Score
Energy Saving < 15%	0%
Energy Saving = 15% (prerequisite)	50%
15% ≤ Energy Saving ≤ 50%	50% ≤ Criterion Score ≤ 100%

11.9.2 En-9.2: Peak Load Reduction

11.9.2.1 Criterion Reference and Title

En-9.2: Peak Load Reduction

11.9.2.2 Criterion Type

Optional

11.9.2.3 Intent

To reduce the building peak electricity demand and subsequent need for utility infrastructure increase through efficient building design and operation.

11.9.2.4 General Requirements

Implementing strategies to reduce the peak electricity demand of the project can (1) reduce the load on the supply infrastructure, (2) achieve improved distribution network stability, and (3) reduce the project's electricity bills by reducing consumption during periods of high electricity tariffs. These demand-side management strategies include

- A demand response program to reduce, flatten or shift demand
- A direct load shifting/scheduling to off-peak hours
- An energy storage to be used during peak demand
- Alternative energy sources

The peak and annual average electrical load must be determined through dynamic energy modeling using hourly simulation software. The simulation must include all building energy systems and incorporate all peak load reduction strategies.

The peak load factor is calculated by dividing the peak electricity demand by the annual average electricity demand of the project.

$$\text{Peak Load Factor} = \frac{Peak\ Electricity\ Demand}{Annual\ Average\ Electricity\ Demand}$$

An example of dynamic energy modeling results is shown in the annual load profile below. The peak electrical demand (A) and the annual average electrical demand (B) are shown on the graph.

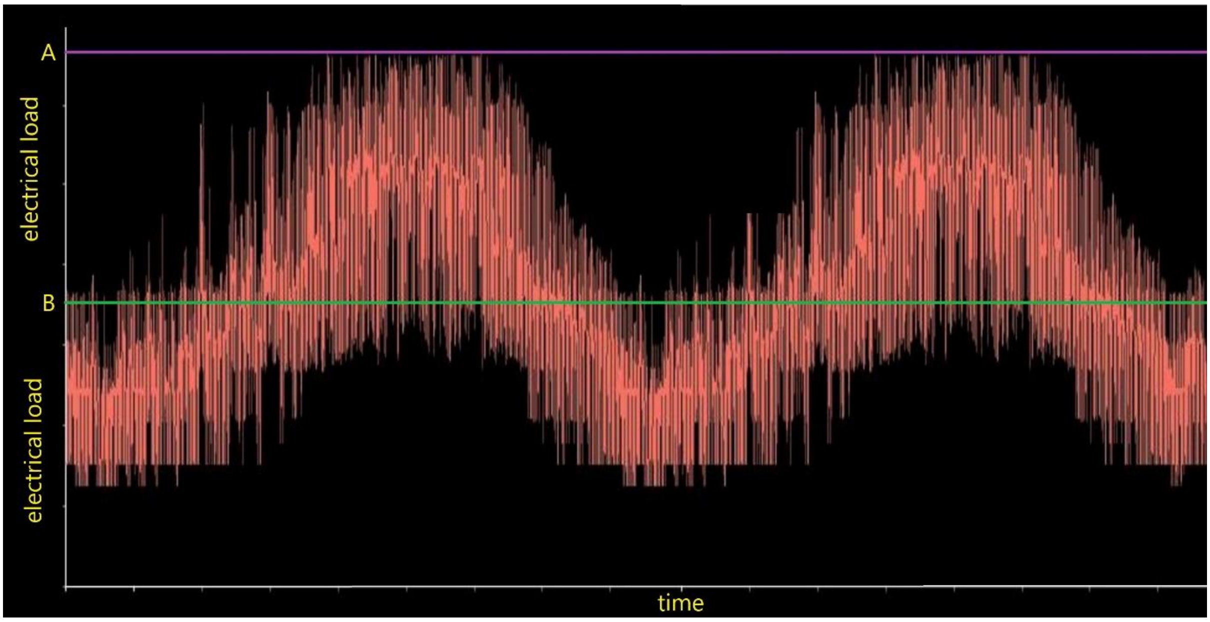


Figure 11.9.2-1. Annual load profile – example

A= Peak Electrical Demand (kW)
B= Annual Average Electricity Demand (kW)

The score for this criterion is determined based on the achieved peak load factor of the Facility. The minimum requirements are as follows:

- The peak load factor should be lower than 2.5 in order to be eligible for this criterion.

11.9.2.5 Special Requirements

None

11.9.2.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.9.2-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.

Submittal Name	Submittal Description
Schedule of Energy Consuming Equipment	- The schedule of energy consuming equipment should include the power consumption and the operating schedule of each piece of equipment.
Details on Peak Load Reduction Strategies	- This includes the description of each strategy, the design drawings and the specifications of each system and piece of equipment.
Dynamic Energy Modeling Report	- The dynamic energy modeling report should include the design input data and the output results showing the peak and the average energy demand.
Calculations of the Peak Load Factor	- The calculations of the peak load factor should include the annual load profile showing the peak and the average energy demand.
New Building in Construction Phase	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Schedule of energy consuming equipment	- The schedule of energy consuming equipment should include the power consumption and the operating schedule of each piece of equipment.
Details on peak load reduction strategies	- This includes the description of each strategy, the as-built drawings, the datasheets or the nameplate photos of each system and piece of equipment.
Dynamic energy modeling report	- The dynamic energy modeling report should include the design input data and the output results showing the peak and the average energy demand.
Calculations of the peak load factor	- The calculations of the peak load factor should include the annual load profile showing the peak and the average energy demand.
Existing Building	
Criterion Narrative	- The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Schedule of Energy Consuming Equipment	- The schedule of energy consuming equipment should include the power consumption and the operating schedule of each piece of equipment.
Details on Peak Load Reduction Strategies	- This includes the description of each strategy, the as-built drawings, the datasheets or the nameplate photos of each system and piece of equipment.

Submittal Name	Submittal Description
Dynamic Energy Modeling Report OR Annual Power Logging Data (hourly) of the Facility	- The dynamic energy modeling report should include the design input data and the output results showing the peak and the average energy demand. OR - The annual power logging data should include the peak and the average load of the Facility.
Calculations of the Peak Load Factor	- The calculations should include the annual load profile showing the peak and the average energy demand.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.9.2.7 Score Allocation

The score for this criterion is determined based on the peak load factor. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * F_1$$

Where

- F_1 is calculated using the following formula:
  If 1.5 ≤ Peak Load Factor ≤ 2.5,
  $$F_1 = 1 - \frac{(Peak\ Load\ Factor - 1.5)}{1}$$
  If Peak Load Factor < 1.5, $F_1 = 1$
  If Peak Load Factor > 2.5, $F_1 = 0$

A project earns a score of 100% if the achieved peak load factor is less than or equal to 1.5.

11.9.3En-9.3: Energy Auditing

11.9.3.1 Criterion Reference and Title

En-9.3: Energy Auditing

11.9.3.2 Criterion Type

Optional

11.9.3.3 Intent

To conduct an energy audit to calculate the energy use, and to identify simple ways to save energy by implementing certain conservation measures.

11.9.3.4 General Requirements

An energy audit should be conducted and reported by a qualified third-party energy audit expert, or directly by a qualified Energy Service Company (ESCO) to optimize the energy efficiency of the system by relying on the following measures:

Measurement and verification, calculations, audit observations, reports, discussions, identification of potential conservation measures, planning and process finalization then implementation.

An energy audit should be conducted for each project type and for each area of use:

- Energy metering and control
- Building envelope
- Heating, ventilating, air conditioning and refrigeration with control systems
- Lighting and control systems
- Energy systems (i.e., combustion/steam/compressed air systems)
- Transport system (i.e., elevator/ escalator/ travelator)
- Renewable energy systems
- Water and wastewater treatment system
- Service hot water systems
- Pumping and control systems.

The energy audit must meet the requirements identified in the ASHRAE Procedures for Commercial Building Energy Audits or defined in EN 16247-2:2014 or other equivalent compliant standards. The following outline can be part of the energy audit report:

1. Executive summary
    - Basic building or facility and site visit information
    - Total annual energy use of the building or Facility
    - Estimated savings from energy conservation measures
    - Estimated cost and simple payback.

2. Building or Facility Description
    - Building use and surface in square meter, demographics, and aerial imaging
    - Property and building or Facility overview
    - Energy use characteristics (Energy end-use breakdown)
    - All set points of the HVAC and lighting system
    - All schedules, but not limited to: lighting, power, HVAC, occupancy Building or Facility energy-use performance benchmarking

3. Energy Efficiency Plan

The Energy Efficiency Plan requires
    - Site visit reports with pictures to show the status of all the energy end-uses based on a site walk- through
    - The measurement of the energy consumption, and the use estimates of all the energy-using systems
    - An energy-use balance diagram to track the energy from its sources to its consumption
    - The quantification of costs associated with each energy-using activity
    - The identification of potential measurable, achievable, and realistic conservation measures
    - The estimation of the consumption savings for each conservation measure
    - The cost-benefit analysis of each energy conservation measure
    - The prioritization of the plan to be implemented based on costs, benefits and available manpower
    - The identification of the person who will be responsible for the implementation of the plan.

4. Appendices
    - Data collection sheets, checklists and calculations
    - Copies of energy bills
    - Site drawings and building floor plans

- Interview notes and checklists
- All photographs taken during the site visit
- Description of measurement tools and data loggers
- Terms and Definitions.

11.9.3.5 Special Requirements

None

11.9.3.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.9.3-1. Required Submittals

Submittal Name	Submittal Description
Existing Building	
Qualifications	• The qualifications of the third-party energy audit experts or ESCO.
Energy audit report	• The energy audit report including energy efficiency plan.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.9.3.7 Score Allocation

The score for this criterion is determined based on the conduction and the submittal of the energy audit. If the energy audit is not conducted and reported, the score for this criterion will be 0%. A project earns a score of 100% for this criterion if the energy audit report is conducted and reported.

11.9.4En-9.4: Innovation

11.9.4.1 Criterion Reference and Title

En-9.4: Innovation

11.9.4.2 Criterion Type

Optional

11.9.4.3 Intent

To support innovation and new solutions for the smart use of energy resources with energy reduction through energy-saving technologies, systems or processes which are not rewarded by the standard ARZ criteria.

11.9.4.4 General Requirements

Demonstrate any new smart solution, technology, invention, design, construction, operation, maintenance or demolition method or process, which is not covered in ARZ 2.0, and which proves to be effective in terms of energy performance savings and financial analysis. The innovation must be approved by LGBC during the official rating of the submitted application. The innovation must be significant, achievable and measurable by identifying the following:

- The intent of the proposed innovation criterion
- The proposed general and special requirements for compliance
- The proposed required submittals to demonstrate compliance.

Up to a maximum of 5 innovation items are available in aggregate from a combination of the following:

1) Approved Innovation

One or several innovation credits can be awarded for each innovation application form approved by LGBC after the submittal review process.

2) Exemplary Level of Performance According to the ARZ Criteria in the Energy Module

The project demonstrates exemplary performance if one or more of the following ARZ assessment criteria are met at an exemplary level of performance:

- En-1.2 Energy Submetering
- En-4.2 Domestic Hot Water Energy
- En-7.1 Alternative Energy Sources
- En-8.3 Energy Consumption Tracking

- En-8.4 Energy Systems Operation and Maintenance
- En-8.5 Energy Systems Commissioning
- En-9.1 Building Energy Modeling
- En-9.2 Peak Load Reduction

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11.9.4.5 Special Requirements

None

11.9.4.6 Required Submittals

Submit the supporting documents listed in the table hereunder for each stage of the certification review process.

Table 11.9.4-1. Required Submittals

Submittal Name	Submittal Description
New Building in Design Phase	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
Drawings	• Submit the drawings of the proposed innovation or exemplary of performance (if available)
Specifications	• Submit an extract of the specifications of the proposed innovation or exemplary performance (if available).
New Building in Construction Phase	
Criterion Narrative	• The updated Criterion Narrative (if different from the Design Phase)
As-Built Drawings	• Submit the As-built Drawings of the proposed innovation or exemplary performance (if available).
Manufacturer Datasheets	• Submit the Manufacturer Datasheets of the proposed innovation or exemplary performance (if available).
Guideline	• Provide a documentation guideline how the proposed innovation materializes.
Existing Building	
Criterion Narrative	• The Criterion Narrative should give a brief description of the strategy implemented by the project team to help meet the requirements of this criterion.
As-Built Drawings	• Submit the As-built Drawings of the proposed innovation or exemplary performance (if available).

Submittal Name	Submittal Description
Manufacturer Datasheets	• Submit the Manufacturer Datasheets / Catalogs of the proposed innovation or exemplary performance (if available).
Guideline	• Provide a documentation guideline how the proposed innovation materializes.

Note: The above table includes the minimum required documents to demonstrate compliance with this criterion. The project teams are free to submit other supporting documents, which can provide additional relevant information for the certification reviewers to consider.

11.9.4.7 Score Allocation

The score for the innovation criterion is determined based on the innovation or exemplary performance achieved. The weight factor will be set once the ARZ review committee members assess the originality and performance of the submitted innovation.

Table 11.9.4-2. Weight Factor for Each Criterion Requirement

Criterion Requirement	Weight Factor "WF"	
Innovation Feature-1	$\boldsymbol{WF_1}$	58
Innovation Feature-2	$\boldsymbol{WF_2}$	10
Innovation Feature-3	$\boldsymbol{WF_3}$	10
Innovation Feature-4	$\boldsymbol{WF_4}$	10
Innovation Feature-5	$\boldsymbol{WF_5}$	10

The calculator will determine a preliminary score for complying with the requirements as per the weighted average score. In order to determine the criterion score, the following formula is applied:

$$Criterion\ Score = 100 * \left[\frac{\sum_{i=1}^{5}(F_i * WF_i)}{\sum_{i=1}^{5} WF_i}\right]$$

Where

F_i is calculated using the following formula:
If project includes innovation features, F_i=1
If project does not include innovation features, F_i=0

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