



DESIGN REFERENCE GUIDE

INDUSTRIAL FACILITIES

TABLE OF CONTENTS

1	About GreenRE _____	2
2	Introduction _____	2
3	Revision Log _____	2
4	GreenRE Assessment Stages _____	3
5	GreenRE Industrial Facilities Rating System _____	4
6	GreenRE Industrial Facilities Rating System Scoring _____	8
7	GreenRE Industrial Facilities Rating System Criteria _____	9

1. About GreenRE

GreenRE Sdn Bhd is a wholly owned subsidiary of the Real Estate and Housing Development Association (REHDA). The GreenRE rating tool has been developed for the purposes as mentioned herein and may be subject to updating and/or modification in the future.

Any sale, modification, reproduction, display or distribution of GreenRE criteria or any copies thereof is not allowed without GreenRE Sdn Bhd's prior written consent. This may be obtained in writing to the following address or via email to info@greenre.org

GreenRE Sdn Bhd
Wisma Rehda,
No.2C, Jalan SS5/6D,
47301 Petaling Jaya,
Selangor, Malaysia

2. Introduction

The GreenRE assessment scheme was established in 2013 and is a recognized green building rating system tailored for the tropical climate. GreenRE sets parameters and establishes indicators to guide the design, construction and operation of buildings towards increased energy effectiveness and enhanced environmental performance.

The intent of this Design Reference Guide for Industrial Facilities (referred to as "this Guideline") is to establish environmentally friendly practices for the planning, design and construction of buildings, which would help to mitigate the environmental impact of built structures.

This Guideline is not intended to abridge safety, health, environmental or related requirements contained in other applicable laws, codes or policies administered by relevant authorities. Where there is a conflict between a requirement of this Guideline and such other regulations affecting the design, construction and operation of the project, the building regulations shall take precedence.

3. Revision Log

Revision	Description	Date Effective
1.0	Issued for Implementation	22nd November 2018
1.1	Issued for Implementation	June 2023
1.1	Revised for Implementation	January 2024
2.0	Revised for Implementation	February 2026



4. GreenRE Assessment Stages

The GreenRE Industrial Facilities certification process is as follows:



Application

- Submittal of application with relevant supporting documents for certification upon strategic inception of infrastructure project.



Pre-Assessment

- A pre-assessment can be conducted (optional) to give the project team a better understanding of the criteria and evaluation of the certification level sought. This should be performed upon selection of suitable design option to allow teams to identify and maximize opportunities at the earliest stages of the project.



Actual Assessment

- Actual assessment to be conducted once the design and documentary evidences (e.g. approved plan) are ready. After the actual assessment, our assessors will review the documents submitted. Assessment process includes design and documentary reviews to verify if the building project meets:
 - i. The intents of the criteria
 - ii. The pre-requisite requirement for GreenRE Bronze, Silver, Gold and Platinum rating where applicable.
- Provisional Certificate will be issued upon completion of this stage.



Site Verification

- Site verification to be conducted upon project completion.
- Final Certificate will be issued upon completion of this stage.



5. GreenRE Industrial Facilities Rating System

OVERVIEW:

This design guide is to be read in conjunction with the latest Non-Residential Tool (NRB). The GreenRE industrial facilities rating system is divided into six (6) sections as follows:

Part 1 – Energy Efficiency: This category focuses on the approach that can be used in the building design and system selection to optimise the energy efficiency of buildings.

Part 2 – Water Efficiency: This category focuses on the selection of fittings and strategies enabling water use efficiency during construction and building operation.

Part 3 – Environmental Protection: This category focuses on the design, practices and selection of materials and resources that would reduce the environmental impacts of built structures.

Part 4 – Indoor Environmental Quality: This category focuses on the design strategies that would enhance the indoor environmental quality which include air quality, thermal comfort, acoustic control, and daylighting.

Part 5 – Other Green Features: This category focuses on the adoption of green practices and new technologies that are innovative and have potential environmental benefits.

Part 6 – Carbon Emission of Development: This category focuses on the use of carbon calculator to calculate the carbon footprint of the development.

These environment impact categories are broadly classified under two main groups namely (I) Energy Related Requirements and (II) Other Green Requirements.

Energy Related Requirements consist of Part 1- Energy Efficiency where credits are allocated for the various energy efficient designs, practices and features used. A minimum of 30 credits must be obtained from this group to be eligible for certification except for Commercial Terraces ⁽¹⁾. The number of credits achievable for this group is capped at 50 credits (exclude 15 bonus credits that are obtainable under IND 1-14 – On-site Energy Generation).

This design guide is to be read in conjunction with Non-Residential Building toolkit.

Other Green Requirements consist of Part 2 - Water Efficiency; Part 3 - Environmental Protection; Part 4 - Indoor Environmental Quality; Part 5 - Other Green Features and Part 6 - Carbon Emission of Development. Credits are allocated for the water efficient features, environmentally friendly design practices, innovative green features used and carbon footprint of development. A minimum of 20 credits must be obtained from this group to be eligible for certification. The number of credits achievable for this group is also capped at 50 credits.

The maximum GreenRE score achievable for a project is capped at 100 credits and this does not include 15 bonus credits that are obtainable under Energy Related Requirements if a project uses on-site energy generation sources.

¹ Commercial terraces typically refer to rows of connected commercial units or shop lots, purposed for retail, office, or mixed commercial activities



Framework:



**Elective Requirement for Energy Improvement
(Combination of the following items to meet 30 credits)**

**Elective Requirement for Other Areas
(Combination of the following items to meet 20 credits)**

PART 1 - ENERGY EFFICIENCY

PART 2 - WATER EFFICIENCY

- IND 1-1 Thermal Performance of Building Envelope – OTTV
- IND 1-2 Air-Conditioning System
- IND 1-3 Building Envelope – Design/ Thermal Parameters
- IND 1-4 Natural Ventilation/Mechanical Ventilation
- IND 1-5 Daylighting
- IND 1-6 Artificial Lighting
- IND 1-7 Lighting Zoning
- IND 1-8 Ventilation in Carparks
- IND 1-9 Ventilation in Common Areas
- IND 1-10 Vertical Transportation Efficiency
- IND 1-11 Electrical Services
- IND 1-12 Local Energy Generation for Centralised Service Hot Water Heating
- IND 1-13 Energy Efficiency Practices & Features
- IND 1-14 On-site Energy Generation

- IND 2-1 Water Efficient Fittings
- IND 2-2 Water Usage and Leak Detection
- IND 2-3 Alternative Water Sources
- IND 2-4 Irrigation System and Landscaping
- IND 2-5 Water Consumption of Cooling Tower

PART 3 – ENVIRONMENTAL PROTECTION

- IND 3-1 Sustainable Construction
- IND 3-2 Sustainable Products
- IND 3-3 Greenery Provision
- IND 3-4 Environmental Management Practice
- IND 3-5 Green Transport
- IND 3-6 Stormwater Management
- IND 3-7 Refrigerants

PART 4 - INDOOR ENVIRONMENTAL QUALITY

- IND 4-1 Thermal Comfort
- IND 4-2 Noise Level
- IND 4-3 Indoor Air Pollutants
- IND 4-4 Indoor Air Quality (IAQ) Management
- IND 4-5 External Views
- IND 4-6 Quality of Artificial Lighting

PART 5 – OTHER GREEN FEATURES

- IND 5-1 Green Features & Innovations

PART 6 – CARBON FOOTPRINT OF DEVELOPMENT

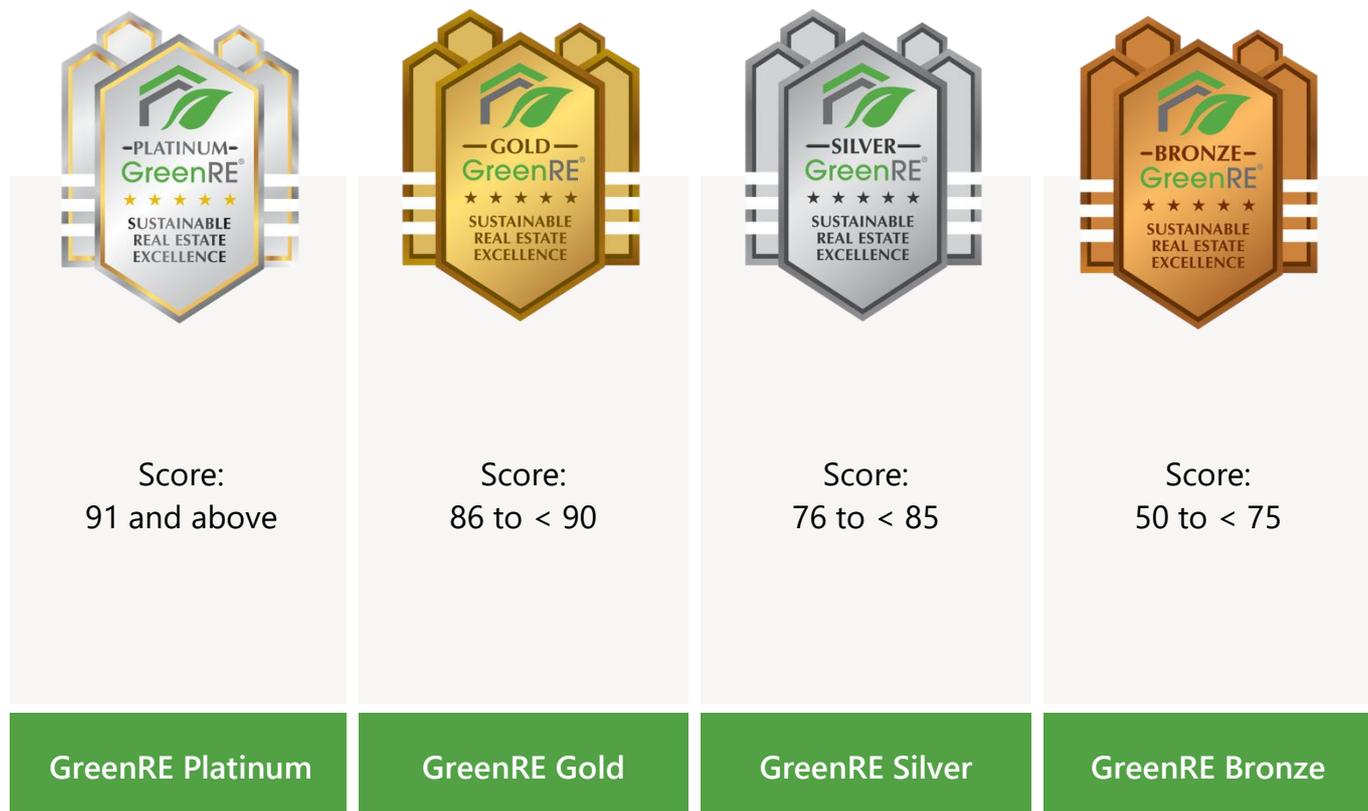
- IND 6-1 Carbon Emission of Development

CREDIT ALLOCATION:

		Category	Credits Allocations	
iii. Energy Related Requirements				
Minimum 30 credits	Part 1: Energy Efficiency			
	IND 1-1 Thermal Performance of Building Envelope – OTTV	Section (A) Applicable to	10	
	IND 1-2 Air – Conditioning System	air-cond. areas	33	
	Sub -Total (A) – IND 1-1 to 1-2			43
	IND 1-3 Building Envelope – Design/Thermal Parameters	Section (B) Applicable to	30	
	IND 1-4 Natural Ventilation/Mechanical Ventilation	non air- cond. areas	20	
	Sub – Total (B) – IND 1-3 to 1-4			50
	IND 1-5 Daylighting	Section(C) Applicable to all areas	6	
	IND 1-6 Artificial Lighting		10	
	IND 1-7 Lighting Zoning		3	
	IND 1-8 Ventilation in Carparks		2	
	IND 1-9 Ventilation in Common Areas		5	
	IND 1-10 Vertical Transportation Efficiency		1	
	IND 1-11 Electrical Services		7	
IND 1-12 Local Energy Generation for Service Hot Water	6			
IND 1-13 Energy Efficiency Practices and Features	10			
IND 1-14 On-site Energy Generation	16			
Sub – Total (C) – IND 1-5 to 1-14			66	
Category Score for Part 1 – Energy Efficiency [Prorate Subtotal (A) + Prorate Subtotal (B)] + Subtotal (C)			116 (MAX)	
(II) Other Green Requirements				
Minimum 20 credits	Part 2: Water Efficiency			
	IND 2-1 Water Efficient Fittings		6	
	IND 2-2 Water Usage and Leak Detection		2	
	IND 2-3 Alternative Water Sources		3	
	IND 2-4 Irrigation System and Landscaping		3	
	IND 2-5 Water Consumption of Cooling Tower		2	
	Category Score for Part 2 – Water Efficiency			16
	Part 3: Environmental Protection			
	IND 3-1 Sustainable Construction		10	
	IND 3-2 Sustainable Products		10	
	IND 3-3 Greenery Provision		8	
	IND 3-4 Environmental Management Practice		10	
	IND 3-5 Green Transport		5	
	IND 3-6 Stormwater Management		3	
	IND 3-7 Refrigerants		2	
	Category Score for Part 3 – Environmental Protection			48
	Part 4: Indoor Environmental Quality			
	IND 4-1 Thermal Comfort		2	
	IND 4-2 Noise Level		2	
	IND 4-3 Indoor Air pollutants		2	
IND 4-4 Indoor Air Quality (IAQ) Management		2		
IND 4-5 External Views		1		
IND 4-6 Quality of Artificial Lighting		2		
Category Score for Part 4: Indoor Environmental Quality			11	
Part 5: Other Green Features				
IND 5-1 Green Features & Innovations		9		
Category Score for Part 5: Other Green Features			9	
Part 6: Carbon Emission of Development				
IND 6-1 Carbon Emission of Development		3		
Category Score for Part 6: Carbon Emission of Development			3	
Category Score for Part 2 to Part 6 – Other Green Requirements			87	

GreenRE Industrial Facilities Score:	203 (MAX)
--------------------------------------	-----------

6. GreenRE Industrial Facilities Rating System Scoring





7. GreenRE Industrial Facilities Rating System Criteria

PRE-REQUISITE



GENERAL

- To be eligible for GreenRE Platinum Rating, roof of entire facility to be solar panel installation ready. Appropriate roof pitch (5-30 degrees tilt from horizontal), static loads, mounting system, and roof access to be considered.
- Provision of Building User Guide and Sustainable Operation Management Guide
- Building Energy Intensity (BEI) calculation, proper submetering is essential. Projects must ensure that energy consumption is accurately tracked through dedicated submeters.
- Minimum score under IND 1-6 Artificial Lighting

GreenRE Gold	≥ 5 credits
GreenRE Platinum	≥ 5 credits

- IND 2-1 Water Efficient Fittings – To demonstrate reduction of portable water usage by 10% from baseline.
- Minimum score under IND 3-1 Sustainable Construction

GreenRE Gold	≥ 3 credits
GreenRE Platinum	≥ 5 credits

- Minimum score under IND 3-2 Sustainable Products

GreenRE Gold	≥ 3 credits
GreenRE Platinum	≥ 5 credits

- IND 3-3(a) Green Plot Ratio site inventory analysis and carbon sequestration calculation
- IND 3-4(a) Environmental Management Plan (EMP) during construction
- IND 3-4(g) Provision of Building User Guide and Sustainable Operation Management Guide
- IND 3-4(i) Provision of facilities or recycling bins for collection and storage of different recyclable waste such as paper, glass, plastic etc and establish the Waste Management Route and provide recycler details.

- IND 4-1(a) To meet the minimum requirement of ASHRAE 62.1. Ventilation for Acceptable Indoor Air Quality for buildings with centralized air conditioning system
- IND 6-1(a) & (b) & (c) Calculation of operational and embodied carbon



MINIMUM SYSTEM EFFICIENCY

Air-conditioned Buildings

Minimum Design System Efficiency/Operating System Efficiency (DSE/OSE)

- For buildings using Water-Cooled Chilled Water Plant

GreenRE Rating	Building Cooling Load (RT)	
	< 500	≥ 500
	Efficiency ⁽¹⁾ (kW/RT)	
Bronze	0.85	0.75
Silver	0.80	0.70
Gold	0.75	0.68
Platinum	0.70	0.65

- For buildings using Air-Cooled Chilled Water Plant or Unitary Air-Conditioner

GreenRE Rating	Building Cooling Load (RT)	
	< 500	≥ 500
	Efficiency ⁽¹⁾ (kW/RT)	
Bronze	1.1	1.0
Silver	1.0	1.0
Gold	0.85	Case by case(i)
Platinum	0.78	

For building with building cooling load of more than 500RT, the use of air cooled central chilled water plant or other unitary air-conditioners are not encouraged for Gold and Platinum ratings. In general, the system efficiency of the air cooled central chilled-water plant and other unitary air-conditioners are to be comparable with the stipulated efficiency for water-cooled central chilled-water plant. Buildings that are designed with air cooled systems

(e.g. stratified and/or multi-block developments) and seeking Gold / Platinum GreenRE rating will be assessed on a case-by-case basis.

Points scoring and fulfilment of pre-requisite for air-conditioning will be allowed if the air conditioning provided by developer for NLA.

Fulfilment of pre-requisite for air-conditioning without point scoring:

- Included in building user guide.
- For gold and platinum projects, savings in energy model to reflect efficiency of air-conditioners proposed in building user guide.

Note: The performance of the overall air-conditioning system for the building is based on the Operating System Efficiency (OSE) of the system during normal building operating hours as defined below:

Office Building

Monday to Friday: 9am to 6pm

Hotel and Hospital:

24-hour

Retail Mall:

Monday to Sunday: 10am to 9pm

Industrial and Other Building Types:

To be determined based on the operating hours

Institutional:

Monday to Friday: 9am to 5pm



ENERGY EFFICIENCY COMPLIANCE



Option 1: Energy Saving

To demonstrate the stipulated energy savings over its reference model using an energy modelling for Gold & Platinum / calculation for Bronze & Silver. Details and submission requirements on energy modelling can be found in Appendix A Energy Modelling Guideline.

Energy Savings (excluding process load):

GreenRE Rating	Energy Saving Required (%)
Gold	25
Platinum	30



Option 2 – Building Energy Intensity (BEI) Benchmarking

To demonstrate the stipulated Building Energy Intensity (BEI) using an energy modelling framework set out. Details and submission requirements on energy modelling can be found in Appendix A Energy Modelling Guideline.

BEI is derived using the following equation:

$$\text{BEI} = [(\text{TBEC} - \text{CPEC}) / (\text{GFA excluding carpark} - \text{GLA} \times \text{FVR})]$$

Where:

TBEC = Total building energy consumption excluding renewable energy replacement (kWh/year)

CPEC = Car Park Energy Consumption in (kWh/year)

GFA = Gross Floor Area (exclude car park area) (m²)

GLA = Gross Lettable Area (m²)

FVR = Floor Vacancy Rate (NLA) (m²)

Building Type	Gold (kWh/m ² /year)	Platinum (kWh/m ² /year)
Light Industrial Buildings	50	45



CHILLER PLANT M&V INSTRUMENTATION

- Provision of permanent measuring instruments for monitoring of water-cooled chilled-water system and air-cooled chilled water system operating system efficiency. The installed instrumentation shall have the capability to calculate resultant plant operating system efficiency (i.e. kW/RT) within 5% of its true value and in accordance with ASHRAE Guide 22 and AHRI 550/590. Heat balance test for water-cooled chilled water system is required for verification of the accuracy of the Measurement and Verification (M&V) instrumentation.



NON -AIR-CONDITIONED BUILDINGS

- To be eligible for GreenRE Platinum Rating, ventilation simulation must be carried out to identify the most effective building design and layout. The simulation results and the recommendations derived are to be implemented to ensure good natural ventilation and demonstrate that 40% of the typical units achieve area weighted average wind velocity of 0.4m/s or alternatively, to conduct thermal comfort modelling to achieve a PMV of +/- 1.

Note: Assistance from ceiling fan is allowable to improve the thermal comfort of a space whereby ventilation simulation shall prove that unassisted ventilation (NV) complies with the minimum requirement of 0.14 m/s wind velocity.



- To be eligible for GreenRE Platinum Rating, roof of entire facility to be solar panel installation ready. Appropriate roof pitch (5-30 degrees tilt from horizontal), static loads, mounting system and roof access to be considered.



MANDATORY REQUIREMENTS:



BUILDING ENVELOPE - OTTV

- The OTTV of the building envelope for a building, having a **total air-conditioned area exceeding 1000 m² and above should not exceed 50 W/m².**



ROOF

- In the **case of an air-conditioned building**, the concept of Roof Thermal Transfer Value (RTTV) is applied if the roof is provided with skylight and the entire enclosure below is fully air-conditioned.
- For roofs with skylight, the maximum required RTTV is 25 W/m².



ROOF – U-VALUE

- **The roof of a conditioned space** shall not have a thermal transmittance (U-Value) greater than that tabulated in Table 2-1.

Table 2-1 Maximum U-Value for Roof (W/m²K)

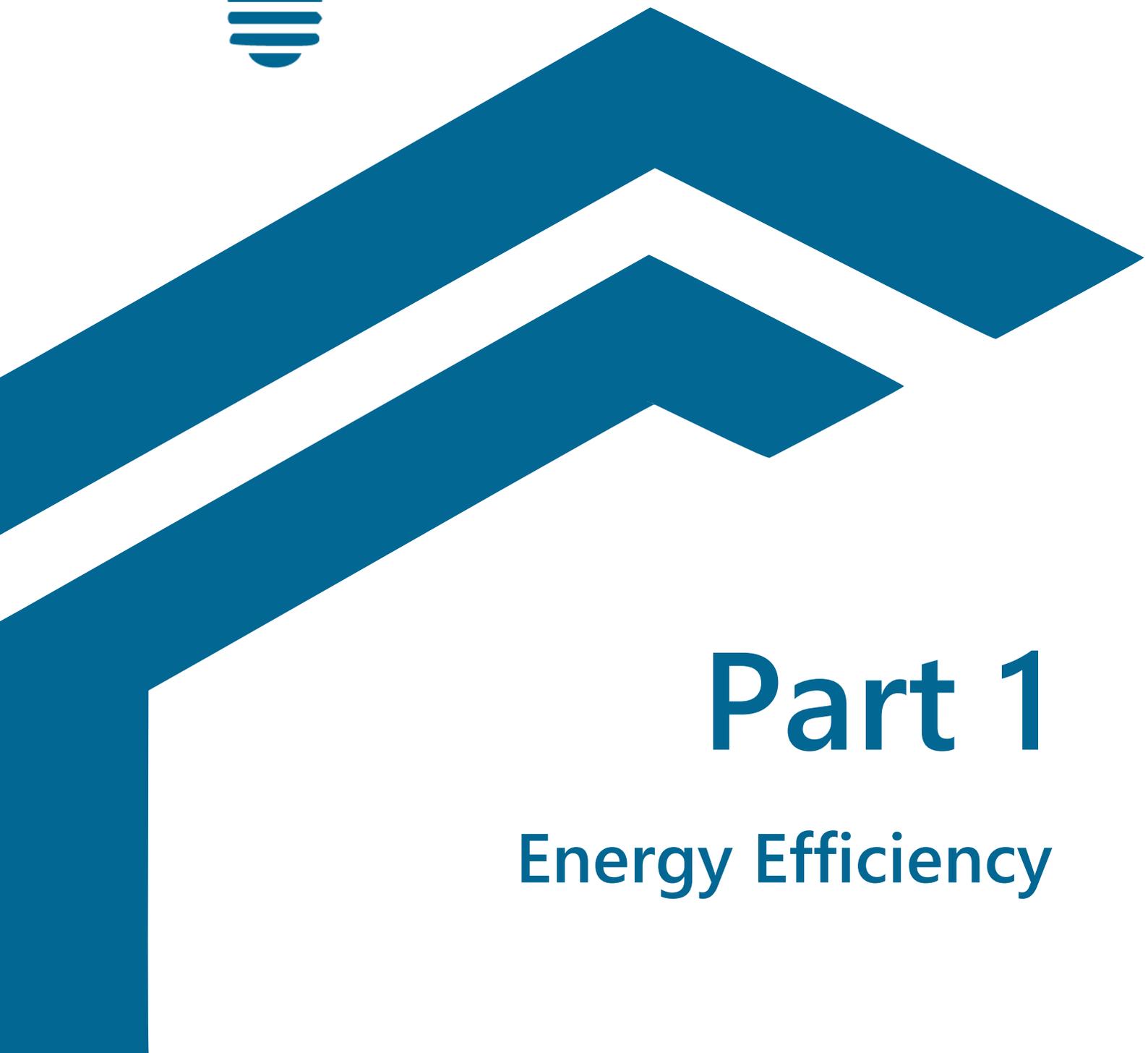
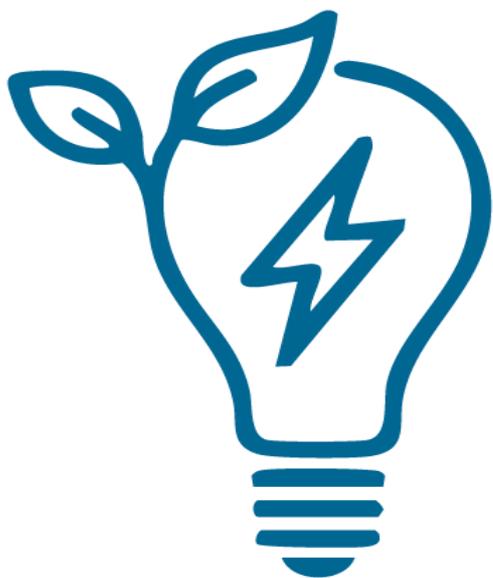
Roof Weight Group	Maximum U-Value (W/m ² K)
Light (Under 50 kg/m ²)	0.4
Heavy (Above 50 kg/m ²)	0.6

- **The roof of a non-airconditioned** space shall either comply to Table 2-1 or the ceiling surface should be low-e (emissivity 0.1 or lower) facing down.



ENERGY MANAGEMENT SYSTEM

- To install Energy Management System where air-conditioned space is greater than 4000m².



Part 1

Energy Efficiency



Part 1 – Energy Efficiency

(A) Applicable to Air-Conditioned Building Area (with an aggregate air-conditioned area > 1000m²)

IND 1-1 THERMAL PERFORMANCE OF BUILDING ENVELOPE – OTTV	GREENRE CREDITS								
<p>Enhance overall thermal performance of building envelope to minimise heat gain thus reducing the overall cooling load requirement.</p> <p>Baseline: Maximum permissible OTTV = 50 W/m²</p>	<p>2 credits for every reduction of 1 W/m² in OTTV from the baseline.</p> <p>Credits scored = $100 - [2 \times (\text{OTTV})]$ where $\text{OTTV} \leq 50 \text{ W/m}^2$ (Up to 10 credits)</p>								
IND 1-2 AIR-CONDITIONING SYSTEM	GREENRE CREDITS								
<p>Encourage the use of better efficiency air-conditioned equipment to minimize the energy consumption. (System efficiency in kW/ton)</p> <p>a. Water-Cooled Chilled-Water Plant:</p> <ul style="list-style-type: none"> • Water-Cooled Chiller • Chilled water pump • Condenser water pump • Cooling tower <table border="1" data-bbox="121 1375 778 1671"> <thead> <tr> <th rowspan="2">Baseline</th> <th colspan="2">Building Cooling Load</th> </tr> <tr> <th>< 500 RT</th> <th>≥ 500 RT</th> </tr> </thead> <tbody> <tr> <td><u>Prerequisite Requirements</u> Minimum system efficiency of central chilled-water plant</td> <td>0.85 kW/RT</td> <td>0.75 kW/RT</td> </tr> </tbody> </table> <p style="text-align: center;">OR</p>	Baseline	Building Cooling Load		< 500 RT	≥ 500 RT	<u>Prerequisite Requirements</u> Minimum system efficiency of central chilled-water plant	0.85 kW/RT	0.75 kW/RT	<p>a. Water-Cooled Chilled-Water Plant</p> <div style="background-color: #4CAF50; color: white; padding: 5px; text-align: center; margin-bottom: 10px;">Building cooling load < 500RT</div> <p>14 credits for achieving plant efficiency of 0.85 kW/ton</p> <p>0.3 credit for every percentage improvement in the chiller plant efficiency better than 0.85 kW/ton</p> <p>Credit scored = $0.3 \times (\% \text{ improvement})$</p> <div style="background-color: #4CAF50; color: white; padding: 5px; text-align: center; margin-bottom: 10px;">Building cooling load ≥ 500RT</div> <p>14 credits for achieving plant efficiency of 0.75 kW/ton</p> <p>0.35 credit for every percentage improvement in the chiller plant efficiency better than 0.75 kW/ton</p> <p>Credit scored = $0.35 \times (\% \text{ improvement})$ (up to 20 credits)</p> <p style="text-align: center;">OR</p>
Baseline		Building Cooling Load							
	< 500 RT	≥ 500 RT							
<u>Prerequisite Requirements</u> Minimum system efficiency of central chilled-water plant	0.85 kW/RT	0.75 kW/RT							



b. Air Cooled Chilled-Water Plant / Unitary Air-Conditioners:

Air-cooled Chilled-Water plant:

- Air-Cooled Chiller
- Chilled Water Pump

Unitary Air-Conditioners:

- Variable Refrigerant Flow (VRF) System
- Water-Cooled Package Unit
- Single-Split Unit
- Multi-Split Unit

Baseline	Building Cooling Load	
	< 500 RT	≥ 500 RT
<u>Prerequisite Requirements</u> Minimum system efficiency of air-cooled chilled water plant or unitary conditioners	1.1 kW/RT	1.0 kW/RT

Note (1): Where there is a combination of centralised air-con system with unitary air-conditioned system, the computation for the credits scored will only be based on the air-conditioning system with a larger aggregate capacity.

c. Air Distribution system:

- Air Handling units (AHUs)
- Fan Coil Units (FCUs)

Baseline – Fan power limitation in air conditioning system

Allowable nameplate motor power	Constant volume	Variable volume
	1.7 kW/m ³ /s	2.4 kW/m ³ /s

Note (2): For buildings using district cooling system, there is no need to compute the plant efficiency under Part 1-2 (a) and (b). The credits obtained will be pro-rated based on the air distribution system efficiency under Part 1-2 (c).

b. Air Cooled Chilled-Water Plant/ Unitary Air-Conditioners

Building cooling load < 500RT

14 credits for achieving plant efficiency of 1.1 kW/ton

0.2 credit for every percentage improvement in the chiller plant efficiency better than 1.1 kW/ton

Credit scored = 0.2 x (% improvement)

Building cooling load ≥ 500RT

14 credits for achieving plant efficiency of 1.0 kW/ton

0.25 credit for every percentage improvement in the chiller plant efficiency better than 1.0 kW/ton

Credit scored = 0.25 x (% improvement)

(up to 20 credits)

c. Air Distribution system:

0.15 credits for every percentage improvement in the air distribution system efficiency over the baseline

Credit scored = 0.15 x (% improvement)

(up to 8 credits)



d. *Prerequisite requirements:* Provision of permanent measuring instruments for monitoring of water-cooled chilled water plant and air-cooled chilled water plant efficiency. The installed instrumentation shall have the capability to calculate resultant plant efficiency (i.e. kW/RT) within 5% of its true value and in accordance with ASHRAE Guide 22 and AHRI 550/590. The following instrumentation and installation are also required to be complied:

- Location of measuring devices to be reviewed by competent person or engineer to ensure accuracy of measurements. Installation of sensors to be performed in accordance to manufacturer's recommendations.
- Data acquisition system to have a minimum resolution of 16 bit.
- All data logging with capability to trend at 1minute sampling time interval for 24 hours a day, 7 days a week.
- Dedicated digital power meters shall be provided for the following groups of equipment: chiller(s), chilled water pump(s), condenser water pump(s) and cooling tower(s).
- Flow meters to be provided for chilled-water and condenser water loop and shall be of ultrasonic / full bore magnetic type or equivalent.
- Temperature sensors are to be provided for chilled water and condenser water loop (minimum four (4) sensors; two (2) for supply and return at chilled water header and similarly two (2) for condenser water header). All thermo-wells shall be installed in a manner that ensures that the sensors can be in direct contact with fluid flow. Provisions shall be made for each temperature measurement location to have one (1) spare thermo-wells located at either side of the temperature sensor for verification of measurement accuracy.

e. *Prerequisite requirements:* Verification of central water cooled chilled-water plant instrumentation: Heat Balance – substantiating test for water cooled chilled-water plant to be computed in accordance with AHRI 550/590. The operating system efficiency and heat balance to be submitted to GreenRE upon commissioning.

Applicable only to buildings with provision of water-cooled chilled water plants

2 credits

1 credit

f. Provision of variable speed controls for chiller plant equipment such as chilled-water pumps and cooling tower fans to ensure better part-load plant efficiency.

1 credit

g. Sensors or similar automatic control devices are used to regulate outdoor air flow rate to maintain the concentration of carbon dioxide.
Indoor carbon dioxide acceptable range ≤ 700 ppm above outdoor concentration.

1 credit

Sub-Total (A):

Sum of GreenRE credits obtained from
IND 1-1 to 1-2

(B) Applicable to Non-Air-Conditioned Building Areas (with an aggregate non-air-conditioned areas > 10% of total floor area excluding carparks and common areas)

IND 1-3 BUILDING ENVELOPE – DESIGN/THERMAL PARAMETERS	GREENRE CREDITS						
<p>Enhance the overall thermal performance of building envelope to minimise heat gain which would improve indoor thermal comfort and encourage natural ventilation or mechanical ventilation.</p>							
<p>a. Minimum direct west facing façade through building design orientation.</p> <p>Note (3): Orientation of façade that falls within the range of 22.5° N of W and 22.5° S of W will be defined as west facing façade. Core walls for lift or staircases and toilets that are located within this range are exempted in computation.</p>	<p>Credits scored = $10 - [0.2 \times (\% \text{ of west facing façade areas over total façade areas})]$</p> <p>(Up to 10 credits)</p> <p>Where there is no west facing façade, the total credits scored for this item will be 25 credits; the IND 1-3 b (i), b (ii) and (c) as listed below will not be applicable.</p>						
<p>b. i. Minimum west facing window opening.</p> <p>ii. Effective sun shading provision for windows on the west façade with minimum shading of 30%.</p>	<p>Credits scored = $10 - [0.1 \times (\% \text{ of west facing window areas over total west facing façade areas})]$</p> <p>Credits scored = $0.1 \times (\% \text{ of west facing window areas with sun shading devices over total west facing façade areas})$</p> <p>(Up to 10 credits for IND 1-3(b)(i) &(b)(ii))</p>						
<p>c. Better thermal transmittance (U-value) of external west facing walls.</p> <p>The U-value of external west facing wall should be equal or less than 2W/m²K</p>	<p>Credits scored = $0.05 \times (\% \text{ of the external west facing walls areas with U-value of } 2 \text{ W/m}^2\text{K or less over the total west facing façade areas})$</p> <p>(Up to 5 credits)</p>						
<p>d. Better thermal transmittance (U-value) of roof.</p> <p>Baseline: U-value for roof stated below depending on the weight range of roof structure:</p> <table border="1" data-bbox="156 1818 743 2024"> <thead> <tr> <th>Roof Weight Group (kg/m²)</th> <th>Maximum U-value (W/m²K)</th> </tr> </thead> <tbody> <tr> <td>Light (Under 50)</td> <td>0.4</td> </tr> <tr> <td>Heavy (Over 50)</td> <td>0.6</td> </tr> </tbody> </table>	Roof Weight Group (kg/m ²)	Maximum U-value (W/m ² K)	Light (Under 50)	0.4	Heavy (Over 50)	0.6	<p>2 credits for every 0.1 W/m²K reduction</p> <p>(Up to 5 credits)</p>
Roof Weight Group (kg/m ²)	Maximum U-value (W/m ² K)						
Light (Under 50)	0.4						
Heavy (Over 50)	0.6						

IND 1-4 NATURAL VENTILATION / MECHANICAL VENTILATION

GREENRE CREDITS

a. Ventilation System

i. Ventilation Design: Encourage building that facilitates good natural ventilation. Proper design of building layout that utilises prevailing wind conditions to achieve adequate cross ventilation.

Note (4): credit can be attempted if window openings facing predominant wind directions and cross ventilation. Local wind rose to be submitted to justify predominant wind directions.

OR

ii. Encourage energy efficient mechanical ventilation system and analysis.

Baseline: Fan power limitation in mechanical ventilation systems

Allowable nameplate motor power	
Nameplate motor power > 4kW	Nameplate motor power < 4kW
0.32 W/CMH	0.17 W/CMH

Note (4): Where there is a combination of naturally ventilated and mechanical ventilated spaces, the credits scored will only be based on the predominant ventilation modes of normally occupied spaces.

1 credit for every 10% of NV areas with window openings facing north and south directions and cross ventilation
Credits scored = 1 x (% units/10)
(Up to 10 credits)

OR

0.4 credit for every subsequent 1% improvement from the baseline
Credits scored = 0.4 x (% improvement)
(Up to 10 credits)

b. Ventilation Simulation Modelling and Analysis

- Ventilation simulation modelling and must be carried out to identify the most effective building design and layout. The simulation results and the recommendations derived are to be implemented to ensure good natural ventilation and demonstrate that 40% of the typical units achieve area weighted average wind velocity of 0.4m/s or alternatively, to conduct thermal comfort modelling to achieve a PMV of +/- 1.

Note: Assistance from ceiling fan is allowable to improve the thermal comfort of a space whereby ventilation simulation shall prove that unassisted ventilation (NV) complies with the minimum requirement of 0.14 m/s wind velocity.

Prerequisite requirement: GreenRE Platinum: Ventilation simulation modelling and analysis are to be carried out to ensure good natural ventilation with minimum weighted average wind velocity of 0.6m/s within the functional spaces or units.

5 credits

(Additional 5 credits if the recommendations are implemented and meet air-flow requirements

(Up to 10 credits)

Sub-Total (B):Sum of GreenRE credits obtained from
IND 1-3 to 1-4



(C) General

IND 1-5 DAYLIGHTING	GREENRE CREDITS								
<p>Encourage design that optimises the use of effective day lighting to reduce energy use for artificial lighting.</p> <p>a. Use of daylight simulation analysis or any relevant calculation to verify that 50% or more of all normally occupied areas achieve adequate daylight illuminance levels as specified in MS 1525:2019. Areas with illuminance levels below or above the range do not comply.</p>	<table border="1"> <thead> <tr> <th data-bbox="820 497 1161 633">Percentage of Occupied Spaces with Adequate Ambient Lighting Level</th> <th data-bbox="1161 497 1417 633">Credits Allocation</th> </tr> </thead> <tbody> <tr> <td data-bbox="820 633 1161 689">50% - 75%</td> <td data-bbox="1161 633 1417 689">1</td> </tr> <tr> <td data-bbox="820 689 1161 745">76% - 90%</td> <td data-bbox="1161 689 1417 745">2</td> </tr> <tr> <td data-bbox="820 745 1161 801">>90%</td> <td data-bbox="1161 745 1417 801">3</td> </tr> </tbody> </table> <p>(Up to 3 credits)</p>	Percentage of Occupied Spaces with Adequate Ambient Lighting Level	Credits Allocation	50% - 75%	1	76% - 90%	2	>90%	3
Percentage of Occupied Spaces with Adequate Ambient Lighting Level	Credits Allocation								
50% - 75%	1								
76% - 90%	2								
>90%	3								
<p>b. Daylighting in the following common areas:</p>	<p>Extent of Coverage: At least 90% of the common area</p>								
<p>i. Lift lobbies and corridors</p>	<p>1 credit</p>								
<p>ii. Staircases</p>	<p>1 credit</p>								
<p>iii. Carparks</p>	<p>1 credit</p>								
IND 1-6 ARTIFICIAL LIGHTING	GREENRE CREDITS								
<p>Encourage the use of better efficient lighting to minimise energy consumption from lighting usage while maintaining proper lighting level.</p> <p><u>Baseline:</u> Luminance level stated in MS 1525:2019</p>	<p>0.20 credit for every percentage improvement in the lighting power budget</p> <p>Credits scored = 0.20 x (% improvement)</p> <p>(Up to 10 credits)</p>								
IND 1-7 LIGHTING ZONING	GREENRE CREDITS								
<p>Lighting zones to not exceed 100m² for 90% of the occupied areas with controls clearly labelled and accessible for occupants</p>	<p>1 credit</p>								
<p>To use photocell and / or motion sensors in the following areas (>90% of spaces):</p>									



Circulation areas (staircases and corridors)	1 credit
Transient spaces (lift lobbies, atrium, toilets)	1 credit
IND 1-8 VENTILATION IN CARPARKS	GREENRE CREDITS
Encourage the use energy efficient design and control of ventilation systems on carparks.	
a. Carparks designed with natural ventilation.	Naturally ventilated carparks (covered and sheltered) – 2 credits
<p>b. CO sensors are used to regulate the demand for mechanical ventilation (MV).</p> <p>Note (5): Where there is a combination of different ventilation mode adopted for car park design, the credits scored under this requirement will be prorated accordingly.</p>	<p>Credits scored based on the mode of mechanical ventilation provided</p> <p>Fume extract- 1 credit MV with or without supply – 1 credit (Up to 2 credits)</p>
IND 1-9 VENTILATION IN COMMON AREAS	GREENRE CREDITS
<p>Encourage the use of energy efficient design and control of ventilation systems in the following common areas:</p> <ul style="list-style-type: none"> • Toilets • Staircases (include BOMBA staircase) • Lift Lobbies • Corridors • Atriums 	<p>Credits scored based on the mode of ventilation provided in the applicable areas.</p> <p>Natural vent. – 1.5 credits for each area Mechanical vent. – 0.5 credit for each area (Up to 5 credits)</p>
IND 1-10 VERTICAL TRANSPORTATION EFFICIENCY	GREENRE CREDITS
Encourage the use of lift with energy efficient features such as sleep mode or regenerative features and motorless lift.	<p>Extent of Coverage: All lifts</p> <p>1 credit</p>



IND 1-11 ELECTRICAL SERVICES	GREENRE CREDITS
<p>Encourage the provision of better energy efficient service transformers, UPS and related controls of energy monitoring.</p>	
<p>a. Energy Use and Sub-metering</p> <p>Promote energy use monitoring with sub-metering to facilitate building operations, and to allow engagement of building occupants.</p> <p>I. Separately meter either</p> <ul style="list-style-type: none">i. Substantial energy uses such as space cooling, domestic hot water, ventilation, lighting and plug loads <p style="text-align: center;">OR</p> <ul style="list-style-type: none">ii. High energy load and process areas <p>II. And link all energy sub-meters to BMS, EMS or other automated system.</p>	<p style="text-align: center;">2 credits</p>
<p>b. Provision of low-loss service transformers</p> <p>Efficiency of service transformers to meet the requirements of MS-1525.</p>	<p style="text-align: center;">2 credits</p>

c. Provision of energy-efficient UPS (uninterrupted power supply)

All UPS operating in the following systems must meet the minimum efficiency: -

i. Double conversion on-line mode

UPS Range (kVA)					
	≥5 to <10	10 to <20	20 - <40	40 - <200	≥200
25% load	82.5%	86.5%	87.5%	89.0%	90.0%
50% load	85.0%	91.0%	91.5%	92.0%	92.5%
75% load	87.0%	92.0%	92.5%	93.0%	93.5%
100% load	87.0%	92.0%	92.5%	93.0%	93.5%

ii. Line interactive or ECO mode

UPS Range (kVA)					
	≥5 to <10	10 to <20	20 - <40	40 - <200	≥200
25% load	85.5%	90%	91%	91.5%	93%
50% load	91.5%	93%	93.5%	94%	95.5%
75% load	92.5%	93.5%	94%	94.5%	96%
100% load	92.5%	93.5%	94%	94.5%	96%

iii. Stand-by mode

UPS Range (kVA)					
	≥5 to <10	10 to <20	20 - <40	40 - <200	≥200
25% load	90%	94%	94.5%	95%	95.5%
50% load	93%	96%	96.5%	97%	97.5%
75% load	94%	96.5%	97%	97.5%	98%
100% load	94%	96.5%	97%	97.5%	98%

The credits awarded will be based on the aggregated kVA meeting the minimum efficiency as a proportion to the total installed kVA for UPS rated ≥ 5 kVA

(Up to 3 credits for IND 1-11 (c))

IND 1-12 LOCAL ENERGY GENERATION FOR CENTRALISED SERVICE HOT WATER HEATING

GREENRE CREDITS

Promote local energy generation from renewable sources or waterside energy recovery to meet service hot water heating demand in industrial facilities:

a. Solar Thermal Hot Water System

The solar thermal hot water system must meet minimum Solar Fraction (SF) of 0.5 or Solar Energy Factor (SEF) of 2.

b. Heat Pumps

The heat pump meeting minimum heating COP of 3.5 under the standard testing conditions as follows:

- Heating water from 15°C to 55°C
- Air source heat of 20°C dry bulb/15°C wet bulb for air-to-water heat pump
- Water source heat of 15°C for water-to- water heat pump

c. Combined Heat and Power (CHP) System

The CHP system such as co-generation or tri-generation must meet the minimum Effective Electrical Efficiency as follows:

Type of CHP	Effective Electrical Efficiency
Combustion turbine-based CHP	0.50
Reciprocating engine-based CHP	0.70

d. Photovoltaic Thermal (PV/T) or other low and zero carbon technology hot water systems

2 credits for every 30% of service hot water needs catered by local energy generation.

(Up to 6 credits)

IND 1-13 ENERGY EFFICIENT PRACTICES & FEATURES	GREENRE CREDITS
<p>Encourage the use of energy efficient practices and features which are innovative and have positive environmental impact</p> <p>a. To create an energy breakdown of entire facility to indicate major energy consumers within the facility and to calculate Building Energy Intensity (BEI).</p> <p>Formula to be standardized as follows:</p> $BEI = [(TBEC - CPEC) / (GFA \text{ excluding carpark} - GLA \times FVR)]$ <p>Where: TBEC = Total building energy consumption excluding the renewable energy replacement (kWh/year) CPEC = Car Park Energy Consumption in (kWh/year) GFA = Gross Floor Area (exclude car park area) (m²) GLA = Gross Lettable Area (m²) FVR = Floor Vacancy Rate (NLA) (m²)</p>	<p>1 credit</p>
<p>b. To benchmark process loads within the facility against industry norms and demonstrate savings.</p> <div data-bbox="158 1245 740 2063" style="border: 1px solid green; padding: 10px;"> <p style="text-align: center; background-color: #4CAF50; color: white; margin: -10px -10px 10px -10px;">Process load within the facility</p> <p style="text-align: center;"><u>Percentage savings compared to industry norms</u></p> <p>iv. For process loads < 25% of TBEC</p> <p style="padding-left: 40px;"><u>10% - 1 credit</u></p> <p style="padding-left: 40px;"><u>20% - 2 credits</u></p> <p style="padding-left: 40px;"><u>>30% - 3 credits</u></p> <p>v. For process loads < 50% of TBEC</p> <p style="padding-left: 40px;"><u>10% - 2 credit</u></p> <p style="padding-left: 40px;"><u>20% - 4 credits</u></p> <p style="padding-left: 40px;"><u>>30% - 6 credits</u></p> <p>vi. For process loads > 50% of TBEC</p> <p style="padding-left: 40px;"><u>10% - 3 credit</u></p> <p style="padding-left: 40px;"><u>20% - 6 credits</u></p> <p style="padding-left: 40px;"><u>>30% - 9 credits</u></p> </div>	<p>Up to 9 credits</p>



IND 1-14 ON-SITE ENERGY GENERATION	GREENRE CREDITS
<p>Encourage on-site energy generation through renewable energy or energy recovery / regeneration:</p>	<p>5 credits for every 1% replacement of electricity (based on total electricity consumption)</p> <p>OR</p> <p>2 credits for every 10% of roof area used for solar panels.</p> <p>(Up to 15 credits)</p>
<p>For facilities where solar panels are not installed, provide solar panel installation ready roof. Appropriate roof pitch, static loads, mounting system and roof access to be considered.</p>	<p>1 credit</p>
<p>Sub-Total (C):</p>	<p>Sum of GreenRE credits obtained from IND 1-5 to 1-14</p>
<p>PART 1 – ENERGY EFFICIENCY</p> <p>CATEGORY SCORE:</p>	<p>Sub-Total (A) $\times \frac{\text{Air-Conditioned Building Floor Area}}{\text{Total Floor Area}}$</p> <p>+</p> <p>Sub-Total (B) $\times \frac{\text{Non Air-Conditioned Building Floor Area}}{\text{Total Floor Area}}$</p> <p>+</p> <p>Sub-Total (C)</p> <p>Where:</p> <p>Sub-Total (A) = Sum of GreenRE Credits obtained Under Section (A) that is IND 1-1 to 1-2</p> <p>Sub-Total (B) = Sum of GreenRE Credits obtained Under Section (B) that is IND 1-3 to 1-4</p> <p>Sub-Total (C) = Sum of GreenRE Credits obtained Under Section (C) that is IND 1-5 to 1-14</p> <p>If either Section (A) or Section (B) is not applicable, no pro-rating of areas is required for the score computation.</p> <p>Total floor area includes air-conditioned area and non-air-conditioned area but excluding car park and common area.</p>



Part 2

Water Efficiency

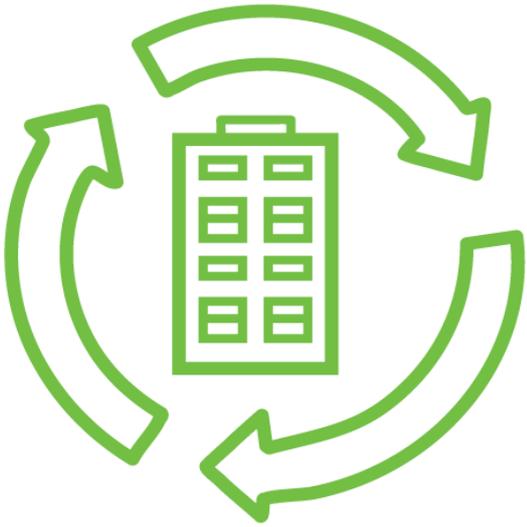


Part 2 – Water Efficiency

IND 2-1 WATER EFFICIENT FITTINGS	GREENRE CREDITS									
<p>Encourage the use of water efficient fittings that are certified under the Water Efficiency Products Labelling Scheme (WEPLS).</p> <ul style="list-style-type: none"> a. Basin taps and mixers b. Flushing cistern c. Showerheads, shower taps and mixers d. Sink/bib taps and mixers e. Urinals and urinal flush valve 	<table border="1" data-bbox="852 577 1423 835"> <thead> <tr> <th colspan="3" data-bbox="852 577 1423 674">Weightage Based on Water Efficiency Products Labelling Scheme (WEPLS)</th> </tr> </thead> <tbody> <tr> <td data-bbox="852 674 1023 752">Efficient *</td> <td data-bbox="1023 674 1214 752">Highly Efficient **</td> <td data-bbox="1214 674 1423 752">Most Efficient ***</td> </tr> <tr> <td data-bbox="852 752 1023 835">2 credits</td> <td data-bbox="1023 752 1214 835">4 credits</td> <td data-bbox="1214 752 1423 835">6 credits</td> </tr> </tbody> </table> <p data-bbox="852 857 1423 925">Credits can be scored based on the number and water efficiency rating of the fitting type used.</p> <p data-bbox="1050 947 1241 981">(Up to 6 credits)</p>	Weightage Based on Water Efficiency Products Labelling Scheme (WEPLS)			Efficient *	Highly Efficient **	Most Efficient ***	2 credits	4 credits	6 credits
Weightage Based on Water Efficiency Products Labelling Scheme (WEPLS)										
Efficient *	Highly Efficient **	Most Efficient ***								
2 credits	4 credits	6 credits								
IND 2-2 WATER USAGE AND LEAK DETECTION	GREENRE CREDITS									
<p>Promote the use of sub-metering and leak detection system for better control and monitoring.</p>										
<ul style="list-style-type: none"> a. Provision of sub-meters for major water uses which includes irrigation, cooling towers etc. 	<p data-bbox="1102 1350 1198 1384">1 credit</p>									
<ul style="list-style-type: none"> b. Linking all sub-meters to Building Management System (BMS) for leak detection. 	<p data-bbox="1102 1482 1198 1516">1 credit</p>									

IND 2-3 ALTERNATIVE WATER SOURCES	GREENRE CREDITS						
<p>Use of suitable systems that utilize alternative water sources for non-potable uses: irrigation, washing, water features, toilet flushing, etc (excluding cooling tower make up water) to reduce use of potable water.</p> <p>Alternative sources can include rainwater, greywater (for toilet flushing only), AHU condensate and wastewater recycling.</p> <p>All the alternative water sources system must be with the provision of submetering for future monitoring</p>	<p>Credits awarded based on % reduction in total potable water usage of the applicable uses</p> <table border="1" data-bbox="842 524 1399 710"> <tr> <td data-bbox="842 524 1129 586">> 50 %</td> <td data-bbox="1129 524 1399 586">3 credits</td> </tr> <tr> <td data-bbox="842 586 1129 647">≥ 10 % to 50 %</td> <td data-bbox="1129 586 1399 647">2 credits</td> </tr> <tr> <td data-bbox="842 647 1129 710">< 10 %</td> <td data-bbox="1129 647 1399 710">1 credit</td> </tr> </table> <p>(Up to 3 credits)</p>	> 50 %	3 credits	≥ 10 % to 50 %	2 credits	< 10 %	1 credit
> 50 %	3 credits						
≥ 10 % to 50 %	2 credits						
< 10 %	1 credit						
IND 2-4 IRRIGATION SYSTEM AND LANDSCAPING	GREENRE CREDITS						
<p>Reduce potable water consumption for irrigation and landscaping.</p>							
<p>a. Use of non-potable water including rainwater for landscape irrigation with provision of submetering for monitoring during the operation.</p>	<p>1 credit</p>						
<p>b. Use of automatic water efficient irrigation system with rain sensor, soil moisture sensor or equivalent control system.</p>	<p>Extent of Coverage: At least 50% of the landscape areas are served by the system</p> <p>1 credit</p>						
<p>c. Use of drought tolerant plants that require minimal irrigation</p>	<p>Extent of Coverage: At least 80% of the landscape areas</p> <p>1 credit</p>						

IND 2-5 WATER CONSUMPTION OF COOLING TOWER	GREENRE CREDITS
Reduce potable water consumption for cooling purpose.	
a. Use of cooling tower water treatment system which can achieve 6 or better cycles of concentration at acceptable water quality.	1 credit
b. Use of recycled water from approved sources for cooling purpose.	1 credit
PART 2 – WATER EFFICIENCY CATEGORY SCORE:	Sum of GreenRE credits obtained from IND 2-1 to 2-5



Part 3

Environmental Protection



Part 3 – Environmental Protection

IND 3-1 SUSTAINABLE CONSTRUCTION

Encourage recycling and the adoption of building designs, construction practices and materials that are environmentally friendly and sustainable.

a. Use of sustainable and recycled materials;

Green Cements with approved industrial by-product (such as Ground Granulated Blast Furnace Slag (GGBS), silica fume, fly ash) to replace Ordinary Portland Cement (OPC).

b. Concrete Usage Index (CUI)

Encourage more efficient concrete usage for building components.

Prerequisite Requirement:

Minimum score under IND 3-1:

GreenRE Gold	≥ 3 credits
GreenRE Platinum	≥ 5 credits

GREENRE CREDITS

% Replacement of OPC by approved industrial by-products	Credits Allocation
10	1
20	2
30	3
40	4
>50	5

(Up to 5 credits)

Project CUI (m3/m2)	Credits Allocation
≤ 0.50	1
≤ 0.45	2
≤ 0.40	3
≤ 0.35	4
≤ 0.30	5

(Up to 5 credits)

IND 3-2 SUSTAINABLE PRODUCTS	GREENRE CREDITS								
<p>Encourage the use of products that are environmentally friendly and sustainable as follow:</p> <ul style="list-style-type: none"> • Eco Label products • Wood products certified by the Forest Stewardship council (FSC) or the Malaysia Certification Council (MTCC) • Agreement of the manufacturer or suppliers for the buyback programmes within the life cycle or at the end of materials life for recycling reuse purpose. 	<table border="1" data-bbox="823 405 1461 674"> <thead> <tr> <th data-bbox="823 405 1166 521">Extent of use of environmentally friendly product</th> <th data-bbox="1166 405 1461 521">Weightage for credit allocation</th> </tr> </thead> <tbody> <tr> <td data-bbox="823 521 1166 573">Low Impact</td> <td data-bbox="1166 521 1461 573">0.5</td> </tr> <tr> <td data-bbox="823 573 1166 624">Medium impact</td> <td data-bbox="1166 573 1461 624">1</td> </tr> <tr> <td data-bbox="823 624 1166 674">High Impact</td> <td data-bbox="1166 624 1461 674">2</td> </tr> </tbody> </table> <p data-bbox="855 712 1461 831">Credits scored will be based on the extent of use of environmentally friendly product. (Up to 8 credits)</p>	Extent of use of environmentally friendly product	Weightage for credit allocation	Low Impact	0.5	Medium impact	1	High Impact	2
Extent of use of environmentally friendly product	Weightage for credit allocation								
Low Impact	0.5								
Medium impact	1								
High Impact	2								
<p>a. Reuse Salvaged Materials</p> <p>Salvage or reuse construction materials for 2% of building materials based on the total material cost (extracted from the bill of quantities).</p>	<p>1 credit</p>								
<p>b. Recycled Content</p> <p>Encourage the utilisation and use of recycled content material so that the total of post-consumer recycled content plus half of the pre-consumer content constitutes at least 10% based on the total material cost.</p> <p><u>Prerequisite Requirement:</u> <i>Minimum score under IND 3-2:</i> GreenRE Gold ≥ 3 credits GreenRE Platinum ≥ 4 credits</p>	<p>1 credit</p>								

IND 3-3 GREENERY PROVISION	GREENRE CREDITS														
<p>Encourage greater use of greenery and restoration of existing trees to reduce heat island effect.</p>															
<p>a. Green Plot Ratio (GnPR) is calculated by considering the 3D volume covered by plants using the Leaf Area Index (LAI).</p>	<table border="1"> <thead> <tr> <th data-bbox="850 517 1158 611">GnPR</th> <th data-bbox="1158 517 1417 611">Credits Allocation</th> </tr> </thead> <tbody> <tr> <td data-bbox="850 611 1158 663">1.0 to < 2.0</td> <td data-bbox="1158 611 1417 663">1</td> </tr> <tr> <td data-bbox="850 663 1158 714">2.0 to < 3.0</td> <td data-bbox="1158 663 1417 714">2</td> </tr> <tr> <td data-bbox="850 714 1158 766">3.0 to < 4.0</td> <td data-bbox="1158 714 1417 766">3</td> </tr> <tr> <td data-bbox="850 766 1158 817">4.0 to < 5.0</td> <td data-bbox="1158 766 1417 817">4</td> </tr> <tr> <td data-bbox="850 817 1158 869">5.0 to < 6.0</td> <td data-bbox="1158 817 1417 869">5</td> </tr> <tr> <td data-bbox="850 869 1158 920">≥ 6.0</td> <td data-bbox="1158 869 1417 920">6</td> </tr> </tbody> </table>	GnPR	Credits Allocation	1.0 to < 2.0	1	2.0 to < 3.0	2	3.0 to < 4.0	3	4.0 to < 5.0	4	5.0 to < 6.0	5	≥ 6.0	6
GnPR	Credits Allocation														
1.0 to < 2.0	1														
2.0 to < 3.0	2														
3.0 to < 4.0	3														
4.0 to < 5.0	4														
5.0 to < 6.0	5														
≥ 6.0	6														
<p>b. Restoration of trees on site, conserving or relocating of existing trees on site (at least 20%).</p>	<p>1 credit</p>														
<p>c. Use of compost recycled from horticulture waste.</p>	<p>1 credit</p>														

IND 3-4 ENVIRONMENTAL MANAGEMENT PRACTICE	GREENRE CREDITS
<p>Encourage the adoption of environmentally friendly practices during construction and building operation.</p>	
<p>a. Implement effective environmentally friendly programmes including monitoring and setting targets to minimise energy use, water use and construction waste during construction stage and include the following practices:</p> <ul style="list-style-type: none"> • To record the electrical consumption during the construction stage and hence, minimise energy usage by on-site utilities. • Appointment of safety, health and environment officer. • To prepare an Environmental Management Plan and conduct a complete Erosion Sedimentation Control Plan (ESCP). • To prepare a Construction Waste Management Plan. 	<p>1 credit</p>

<ul style="list-style-type: none"> • To include commitment to recycle and/or salvage 50% of the volume of non-hazardous construction debris. • Provide at least the minimum level of sanitation/safety facilities for construction workers. • Use a low-flow flushing system and efficient fitting tap in the construction site office/ showroom. • Provision of the Rainwater Harvesting System and the strategies of rainwater. • Develop and implement and IAQ Management plan for Construction. 	
<p>b. Main builder that has good track records in the adoption of sustainable, environmentally friendly, and considerate practices during construction.</p>	<p>1 credit</p>
<p>c. Building quality is assessed under the Quality Assessment System in Construction (QLASSIC) or Construction Quality Assessment System (CONQUAS).</p>	<p>1 credit</p>
<p>d. To performs IBS content scoring based on CIDB IBS scoring scheme.</p>	<p>1 credit for IBS score \geq 50% 2 credits for IBS score \geq 70%</p>
<p>e. Developer, main builder, M&E consultant, and architect are ISO 14000 certified.</p>	<p>0.25 credit for each firm (Up to 1 credit)</p>
<p>f. Project team comprises one Certified GreenRE Accredited Professional (GREAP)/Green Mark Manager (GMM).</p>	<p>1 credit for certified GREAP/GMM</p>
<p>g. Energy policy, energy targets and regular review with top management's commitment as part of an environmental strategy.</p>	<p>1 credit</p>
<p>h. Targets to improve building water performance against own building water performance baseline should be set. To show intent, measures and implementation strategies of water efficiency improvement plans over the next three years.</p>	<p>1 credit</p>



<p>i. Provision of facilities or recycling bins for collection and storage of different recyclable waste such as paper, glass, plastic etc.</p>	<p>1 credit</p>
<p>IND 3-5 GREEN TRANSPORT</p>	<p>GREENRE CREDITS</p>
<p>Promote environmentally friendly transport options and facilities to reduce pollution from individual car use.</p>	
<p>a. Good access (<800m walking distance) to public transport networks such as train stations or bus stops.</p>	<p>1 credit</p>
<p>b. Shuttle service for facility employees.</p>	<p>1 credit</p>
<p>c. Project is accessible from major highway outlets and /or within close proximity to major cargo services (i.e., airport, seaport, railway stations). Project to be within 10km of these facilities.</p>	<p>1 credit</p>
<p>d. Provision of hybrid/electric vehicle charging stations and priority parking lots within the development.</p>	<p>Extent of coverage: Minimum 1 number priority parking bays for every 100 carpark lots. EV chargers – 1 for every 200 parking bays. (Cap at 3) (1 credit)</p>
<p>e. Provision of covered / sheltered bicycles parking lots (i.e., with rack / bar) and adequate shower and changing facilities</p>	<p>Extent of Coverage: Minimum 10 number and maximum 50 numbers of bicycle parking lots (1 credit)</p>



IND 3-6 STORMWATER MANAGEMENT	GREENRE CREDITS
<p>Encourage the treatment of stormwater runoff through provision of infiltration or design features before discharge to public drains.</p> <p>Provision of infiltration features or design features for new development and redevelopment in accordance with MSMA.</p>	<p>Reduce post development stormwater peak discharge rate and quantity from exceeding pre-development peak discharge rate and quantity:</p> <p>5 - 15% - 1 credit 16 - 25% - 2 credits > 25% - 3 credits</p> <p>(Up to 3 credits)</p>
IND 3-7 REFRIGERANTS	GREENRE CREDITS
<p>Reduce the potential damage to the ozone layer and the increase in global warming through the release of ozone depleting substances and greenhouse gases.</p>	
<p>a. Refrigerants with ozone depleting potential (ODP) of zero OR with global warming potential (GWP) of less than 100.</p>	<p>1 credit</p>
<p>b. Use of refrigerant leak detection system at critical areas of plant rooms containing chillers and other equipment with refrigerants.</p>	<p>1 credit</p>
PART 3-ENVIRONMENTAL PROTECTION CATEGORY SCORE:	Sum of GreenRE credits obtained from IND 3-1 to 3-7



Part 4

Indoor Environmental Quality

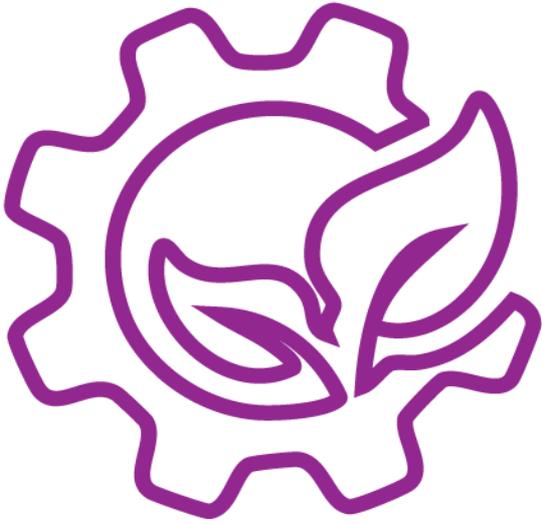
Part 4 – Indoor Environmental Quality

IND 4-1 THERMAL COMFORT	GREENRE CREDITS				
<p><u>For office areas:</u> Air-conditioning system is designed to allow for cooling load variations due to fluctuations in ambient air temperature to ensure consistent indoor conditions for thermal comfort.</p>	0.5 credit				
<p>Meet the minimum requirements of Section 4 through 7 of ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality or any applicable local code, whichever is more stringent and requirement as follow:</p> <ul style="list-style-type: none"> • Indoor temperature between 23°C to 26°C • Relative Humidity between 50% to 70% <p>Note: Additional 0.5 credit will be awarded for room temperature and humidity displays in all applicable areas.</p>	0.5 credit				
<p>and / or <u>For process areas:</u> To ensure thermal comfort is maintained at the following levels:</p> <table border="1" data-bbox="156 1487 730 1608"> <thead> <tr> <th>PMV Range</th> <th>PPD</th> </tr> </thead> <tbody> <tr> <td>-1.0 <PMV<+1.0</td> <td><10</td> </tr> </tbody> </table>	PMV Range	PPD	-1.0 <PMV<+1.0	<10	1 credit
PMV Range	PPD				
-1.0 <PMV<+1.0	<10				

IND 4-2 NOISE LEVEL	GREENRE CREDITS						
<p><u>For office and process areas:</u> Demonstrate acoustic performance of internal partitions as follows:</p> <table border="1" data-bbox="113 533 756 1003"> <thead> <tr> <th data-bbox="113 533 553 667">Description</th> <th data-bbox="553 533 756 667">Sound Transmission Class (STC)</th> </tr> </thead> <tbody> <tr> <td data-bbox="113 667 553 853">Separation between functional spaces within dwelling units and in-between adjacent dwelling units.</td> <td data-bbox="553 667 756 853">40 - 50</td> </tr> <tr> <td data-bbox="113 853 553 1003">Spaces between mechanical and equipment spaces and occupied spaces vii.</td> <td data-bbox="553 853 756 1003">50 - 60</td> </tr> </tbody> </table>	Description	Sound Transmission Class (STC)	Separation between functional spaces within dwelling units and in-between adjacent dwelling units.	40 - 50	Spaces between mechanical and equipment spaces and occupied spaces vii.	50 - 60	<p>1 credit</p>
Description	Sound Transmission Class (STC)						
Separation between functional spaces within dwelling units and in-between adjacent dwelling units.	40 - 50						
Spaces between mechanical and equipment spaces and occupied spaces vii.	50 - 60						
<p>and / or</p> <p><u>For process areas:</u> To make efforts to reduce noise pollution to external environment. Building / plant envelope is designed to reduce noise by NR20dBA in standard operation.</p>	<p>1 credit</p>						
IND 4-3 INDOOR AIR POLLUTANTS	GREENRE CREDITS						
<p>Minimise VOCs, mainly from inside sources to promote a healthy indoor environment.</p>	<p>Extent of Coverage: At least 90% of the internal wall areas.</p>						
<p>a. Use of low volatile organic compounds (VOC) paints certified under local/international certification body.</p>	<p>1 credit</p>						
<p>b. Use adhesives certified under local/international certification body for composite wood products.</p>	<p>1 credit</p>						



IND 4-4 INDOOR AIR QUALITY (IAQ) MANAGEMENT	GREENRE CREDITS
Ensure that building ventilation systems are designed and installed to provide acceptable IAQ under normal operating hours.	
a. Provision of filtration media and differential pressure monitoring equipment in Air Handling Units (AHUs).	1 credit
b. Implement effective IAQ management plan to ensure that building ventilation systems are clean and free from residuals left over from construction activities.	1 credit
IND 4-5 EXTERNAL VIEWS	GREENRE CREDITS
To show that >50% of occupied spaces have a view of out facility within working heights (i.e. 1.2m – 1.7m from floor level).	1 credit
IND 4-6 QUALITY OF ARTIFICIAL LIGHTING	GREENRE CREDITS
Improve workplace lighting quality by avoiding low frequency flicker associated with fluorescent lighting with the use of high frequency ballasts in the fluorescent luminaries.	Extent of Coverage: At least 90% of all applicable areas that are served by fluorescent luminaries
Use of driver with output frequency < 200Hz and < 30% flicker for LED lighting.	1 credit
Part 4 – INDOOR ENVIRONMENTAL QUALITY CATEGORY SCORE:	Sum of GreenRE credits obtained from IND 4-1 to 4-6



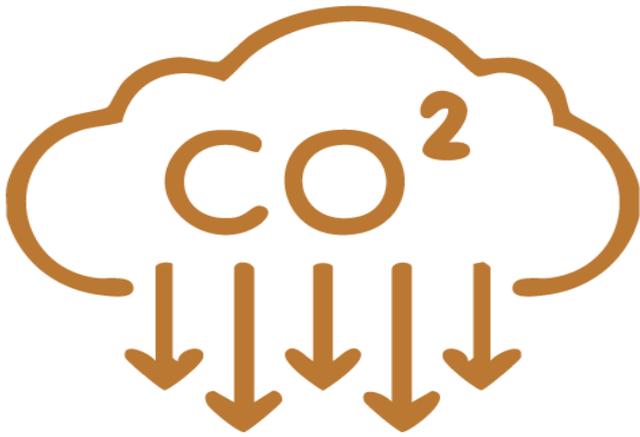
Part 5

Other Green Features



Part 5 – Other Green Features

IND 5-1 GREEN FEATURES & INNOVATIONS	GREENRE CREDITS
<p>Encourage the use of green features which are innovative and have positive environmental impact.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Pneumatic waste collection system • Dual chute system • Self-cleaning façade system • Infiltration trenches • Integrated storm water retention/treatment into landscaping • Heat recovery systems (at least 10% of required capacity) • Etc 	<p>2 credits for high impact item</p> <p>1 credit for medium impact item</p> <p>0.5 credit for low impact item</p> <p>(Up to 9 credits)</p>
<p>PART 5 – OTHER GREEN FEATURES CATEGORY SCORE:</p>	<p>Sum of GreenRE credits obtained from IND 5-1</p>



Part 6

Carbon Footprint of Development



Part 6 – Carbon Footprint of Development

PART 6-1 CARBON EMISSION OF DEVELOPMENT	GREENRE CREDITS
a. Recognise the carbon emission based on operational carbon footprint computation of the building comprising energy [B6] and water consumption [B7].	1 credit
b. Calculation of product stage embodied carbon based on following building materials [A1-A3]: <ul style="list-style-type: none"> • concrete • steel • bricks • cement • metal and aluminium 	0.5 credit
c. Calculation of construction stage embodied carbon [A4-A5]	0.5 credit
d. Reduction from reference embodied carbon (for Ready Mix Concrete, Cement, Steel Reinforcement, Bricks, Steel & Metal)	>10% 0.5 credit >30% 1 credit
PART 6- CARBON EMISSION OF DEVELOPMENT CATEGORY SCORE:	Sum of GreenRE credits obtained from IND 6-1

GreenRE Score (Industrial Facilities)

GreenRE Score (IND) = \sum Category score [(Part 1-Energy Efficiency) + (Part 2-Water Efficiency) + (Part 3-Environmental Protection) + (Part 4-Indoor Environmental Quality) + (Part 5-Other Green Features) + (Part 6-Carbon Emission of Development)]

Where:

Category Score for Part 1 \geq 30 credits and
 \sum Category score for Part 2 to Part 6 \geq 20 credits