DESIGN REFERENCE GUIDE

Existing Data Centre

Version 1.0
1st September 2022

Contents

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.

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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 Existing Data Centre (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.

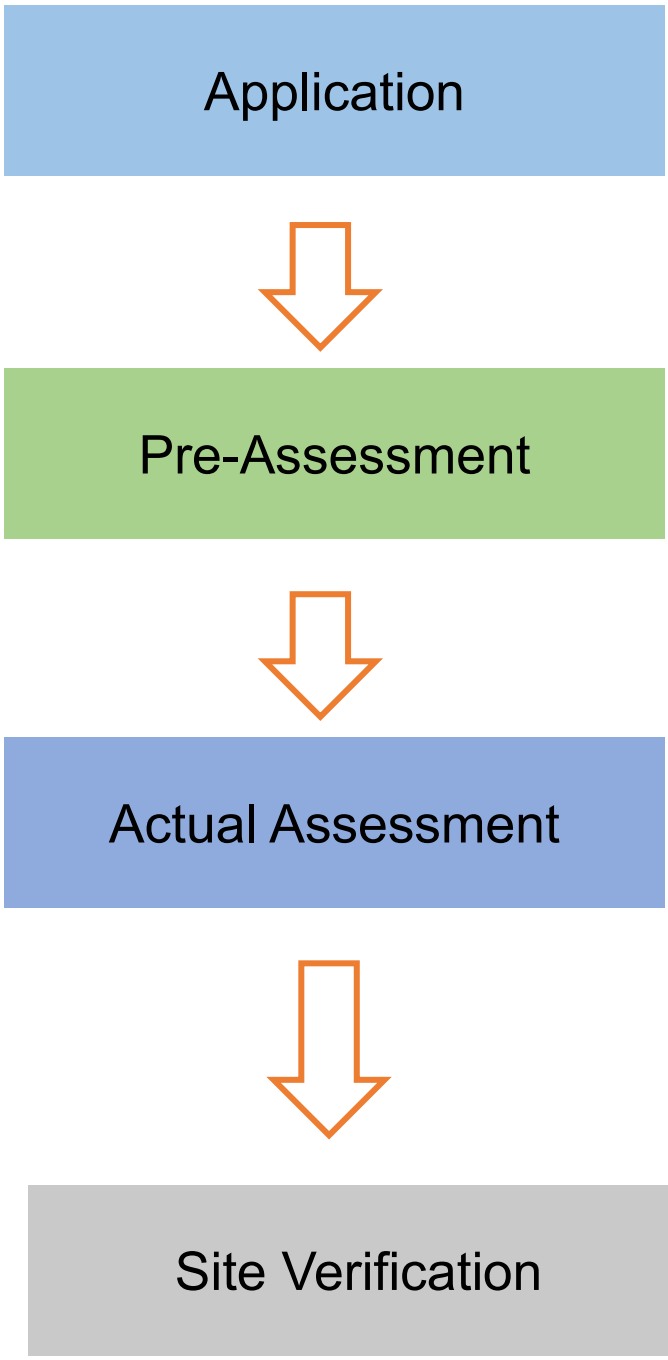
This Guideline is not intended to abridge safety, health, environmental or related requirements contained in other applicable laws, codes or policies administered by relevant authorities. Where there is a conflict between a requirement of this Guideline and such other regulations affecting the design,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

3. Revision Log

Revision	Description	Date Effective
1.0	Issued for use	1st September 2022

4. GreenRE Assessment Stages

The GreenRE Existing Data Centre certification process is as follows:



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

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 maximise opportunities at the earliest stages of the project.

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

5. GreenRE Existing Data Centre Rating System

Overview:

The GreenRE Existing Data Centre criteria consist of six (6) environmental impact categories namely:

(a) Part 1 – Energy Efficiency: This category focuses on the approach that can be used in the Existing Data Centre and public amenities to optimise the energy efficiency of the Existing Data Centre.

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

(c) Part 3 – Sustainable Operation & Management: This category focuses on the sustainability of operation and management that would reduce the environmental impacts upon building operation.

(d) 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 lighting quality.

(e) 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.

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

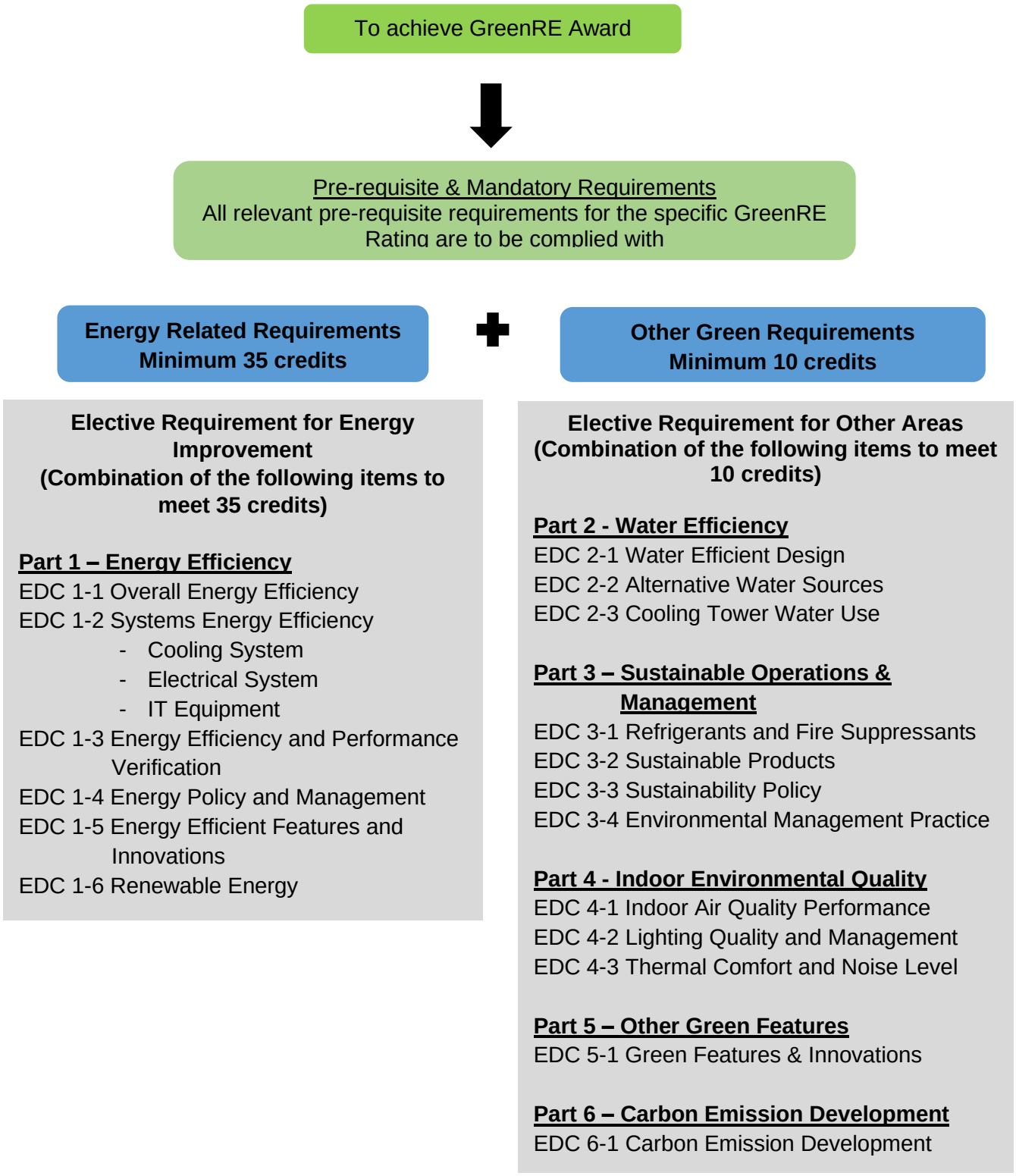
These environment impact categories are broadly classified under two main grouping namely (I) Energy Related Requirements and (II) Other Green Requirements.

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 35 credits must be obtained from this group to be eligible for certification. The number of credits achievable for this group is capped at 50 credits (exclude 15 bonus credits that are obtainable under EDC 1-6 – Renewable Energy).

Other Green Requirements consist of (b) Part 2–Water Efficiency; (c) Part 3 – Sustainable Construction & Management; (d) Part 4 – Indoor Environmental Quality; (e) Part 5 – Other Green Features and (f) Part 6 – Carbon emission. A minimum of 10 credits must be obtained from this grouping 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. This rating tool is to be read in conjunction with NDC v1.0, NRB v3.1 and ENRB v3.1.

Framework for Existing Data Centre (EDC)



Credit Allocation:

	Category	Credits Allocation
	(I) Energy Related Requirements	
Minimum 35 credits	**Part 1: Energy Efficiency**	
	EDC 1-1 Overall Energy Efficiency - PUE improvements over Reference Model	27
	EDC 1-2 Systems Energy Efficiency - Cooling System (including Air Management System) - Electrical System - IT Equipment	14 9 8
	EDC 1-3 Energy Efficiency and Performance Verification - Energy Assessment and Energy Audit - Building Management System - Energy Metering and Reporting of PUE	3 2 5
	EDC 1-4 Energy Policy and Management - Data Centre Operations and Energy Management	5
	EDC 1-5 Energy Efficient Features and Innovations	8
	EDC 1-6 Renewable Energy	5
	Category Score for Part 1 – Energy Efficiency	**86**
	(II) Other Green Requirements	
Minimum 10 credits	**Part 2: Water Efficiency**	
	EDC 2-1 Water Efficient Design	4
	EDC 2-2 Alternative Water Sources	3
	EDC 2-3 Cooling Tower Water Use	6
	Category Score for Part 2 – Water Efficiency	**13**
	Part 3: Sustainable Operations & Management	
	EDC 3-1 Refrigerants and Fire Suppressants	4
	EDC 3-2 Sustainable Products	6
	EDC 3-3 Sustainable Policy	3
	EDC 3-4 Environmental Management Practice	4
	Category Score for Part 3 – Sustainable Operations & Management	**17**
	Part 4: Indoor Environmental Quality	
	EDC 4-1 Indoor Air Quality Performance	6
	EDC 4-2 Lighting Quality and Management	2
	EDC 4-3 Thermal Comfort and Noise Level	2
	Category Score for Part 4: Indoor Environmental Quality	**10**
	Part 5: Other Green Features	
	EDC 5-1 Green Features & Innovations	10
	Category Score for Part 5: Other Green Features	**10**
	Part 6: Carbon Emission of Development	3
	EDC 6-1 Carbon Emission of Development	**3**
	Category Score for Part 2 to Part 6 – Other Green Requirements	**53**
	GreenRE Existing Data Centre Building Score:	**139 (MAX)**

6. GreenRE Existing Data Centre System Scoring

Score	Rating
90 and above	GreenRE Platinum
85 to < 90	GreenRE Gold
75 to < 85	GreenRE Silver
50 to < 75	GreenRE Bronze

7. GreenRE Existing Data Centre Rating System Criteria

Pre-requisite

PART 1 - ENERGY EFFICIENCY

1. OVERALL ENERGY EFFICIENCY

GreenRE Rating	Minimum credits
GreenRE Bronze	35 credits
GreenRE Silver	42 credits
GreenRE Gold	50 credits
GreenRE Platinum	60 credits

2. MAXIMUM PUE

The Data Centre must have a design Power Usage Effectiveness (PUE) at full load condition of no more than 2.2 for GreenRE certification

3. MINIMUM COOLING SYSTEMS' EFFICIENCY

Prescribed system efficiency of cooling system to be as follows:

(i) For Data Centre using Water Cooled Chilled-Water Plant:

GreenRE Rating	Peak Data Centre Cooling Load (RT)	
	< 500	≥ 500
	Efficiency(1) (kW/RT)	
Gold	0.75	0.68
Platinum	0.70	0.65

(ii) For Data Centre using Air Cooled Chilled-Water Plant or Unitary Air-Conditioners:

GreenRE Rating	Peak Data Centre Cooling Load (RT)	
	<500	≥ 500
	Efficiency(1) (kW/RT)	
Gold	0.85	Not applicable (2)
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 applicable for Silver and higher ratings.

Note:

(1) For data centres with peak cooling load of more than 500 RT, the use of air cooled central chilled-water plant or other unitary air-conditioners are not applicable for Silver and higher 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. Data centres that are designed with air-cooled systems and for higher GreenRE rating will be assessed on a case-by-case basis.

4. ENERGY METERING AND REPORT OF PUE

(i) 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 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 M&V instrumentation.

- Location and installation of the measuring devices to meet the manufacturer's recommendation.
- Data acquisition system shall be able to record and store values up to at least 3 decimals places.
- All data logging with capability to trend at 1-minute sampling time interval.
- 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 and shall have an end- to-end measurement uncertainty not exceeding ±0.05°C over entire measurement or calibration range. 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 two spare thermo-wells located at both side of the temperature sensor for verification of measurement accuracy.
- 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.

(ii) The data centre shall be equipped at a minimum with energy metering to provide total facility power and energy usage and total IT equipment power and energy usage on a historical basis, in order to determine instantaneous and average PUE data. The number and type of meters that are required to be installed shall be determined by the data centre design, but at the minimum shall be 1½% percent accuracy, full-scale and provided to meter all forms of energy to the data centre, (electricity, natural gas, steam, chilled water, one-pass cooling, etc.) and at the output of the UPS or PDUs, if this is the source of power that serves the IT equipment.

5. INDOOR ENVIRONMENTAL QUALITY – FOR OCCUPIED AREAS

IAQ Audit - to conduct a full IAQ audit three yearly that complies with Code of Practice on Indoor Air Quality, Department of Occupational Safety and Health, Ministry of Human Resources Malaysia (2010) including "Guidance Note on Ventilation and Indoor Air Quality for Non-Residential setting during Covid-19 Pandemic"

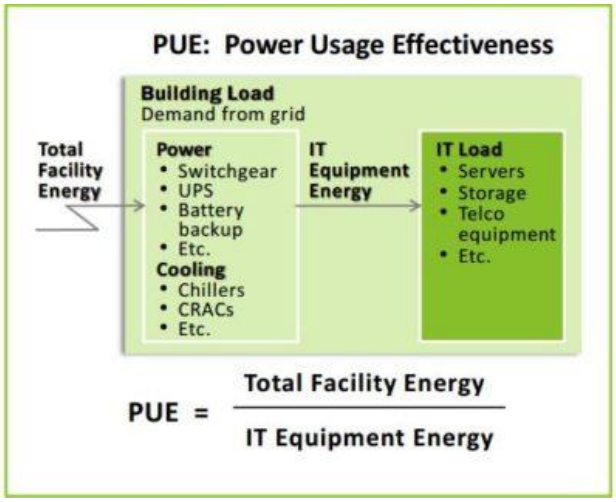
Note: IAQ audit applies only to occupied, air-conditioned areas of building.

Note:
Where a particular section is not applicable to the data centre assessed, the actual score awarded will be normalised with respect to the total maximum score ess the score of the non-applicable section

Part 1 – Energy Efficiency	GreenRE credits

EDC 1-1 OVERALL ENERGY EFFICIENCY

The **PUE** value is defined as the total energy used by a data centre divided by the energy used by IT equipment in that data centre. The total energy used by the data centre shall be taken at the point where the facility is metered. The IT equipment load shall be based on PDU output [PUE Cat. 2]. The PUE categories listed are in accordance with MCMC MTSFB TC G004:2015 – *Technical Code of Specification of Green Data Centres.*



This PUE will also need to be verified in relation with section EDC1-3 on Energy Efficiency and Performance Verification. For verification purposes, if UPS output data is not available, the closest direct measured power data will be used and a fixed PDU loss will be applied based on industry norms for such equipment.

As data centres often operate at less than full load conditions, the energy efficiency at part load conditions contribute significantly to the overall energy consumption. The design of data centre equipment and cooling systems should aim to achieve part load efficiencies that approach full load conditions. The performance of data centres operating at part load conditions will be graded against a reference grade line.

Energy performance of each data centre space must be based on actual metered energy consumption.

Points based on PUE results obtained (maximum 27 points)

Design Full Load PUE	Credits
2.2	8
2.1	10
2.0	12
1.9	16
1.8	18
1.7	21
1.6	24
1.5 & below	27

Points will be interpolated for PUE values between those in the table.

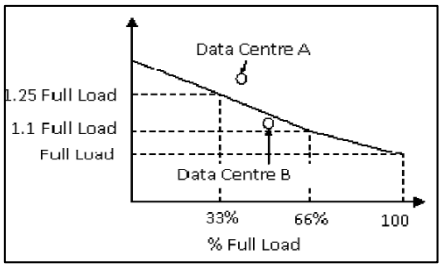
The actual operating PUE will be determined against a reference grade line, depending on the % of full load operation. An operating PUE above this line will be awarded 75% of full load PUE points.

The reference grade line is formed by joining the three points at a) Full Load PUE, b) 1.1 times Full Load PUE at 66% of full load, and c) 1.25 times Full Load PUE at 33% of full load.

Example of application of actual operating PUE:

Data Centre A
Full-Load PUE = 1.5 → 27 pts
1.1 Full-Load PUE = 1.65
1.25 Full-Load PUE = 1.875
Actual Operating PUE = 1.9 @ 40% Full-Load
PUE Points awarded = 0.75 × 27 = 20 pts

Data Centre B
Full-Load PUE = 1.6 → 24 pts
1.1 Full-Load PUE = 1.76
1.25 Full-Load PUE = 2.0
Actual Operating PUE = 1.8 @ 50% Full-Load
PUE Points awarded = 1.0 × 24 = 24 pts



EDC 1-2 SYSTEMS ENERGY EFFICIENCY

Overall Existing Data Centre Energy Efficiency must be corroborated by the component systems efficiency in order to identify areas of improvement in the data centre operations.

(i) 1-2-1 Cooling System

Encourage the use of high efficiency cooling system both in terms of equipment efficiency and system configuration, to minimize the energy consumption.

The performance of the overall cooling system for the data centre shall be based on the efficiency at full installed design capacity (N) plus any additional capacity that is required to maintain continuous availability of the service during operation (e.g. N+1).

The systems to be considered are as follows:

(a) Water-Cooled Chilled-Water Plant, comprising:

a) Water-Cooled Chiller
b) Chilled water pump
c) Condenser water pump
d) Cooling tower or Heat Rejection Unit

Baseline Prerequisite Requirements	Peak Cooling Load	
	< 500 RT	≥ 500 RT
Minimum water-cooled central chilled-water plant efficiency	0.85 kW/RT	0.75 kW/RT

Note:
Stricter minimum performance applies for Silver and higher ratings (see pre-requisite requirements)

(a) Water-Cooled Chilled-Water Plant

Peak data centre cooling load < 500 RT

7 credits for meeting the prescribed chilled-water plant efficiency of 0.85 kW/ton

0.15 credit for every percentage improvement in the chiller plant efficiency better than 0.85 kW/ton

Credits scored = 7 + (0.15 x %improvement)

Peak data centre cooling load ≥ 500 RT

7 credits for meeting the prescribed chilled-water plant efficiency of 0.75 kW/ton

0.175 credit for every percentage improvement in the chiller plant efficiency better than 0.75 kW/ton

Credits scored = 7 + (0.175 x % improvement)

(up to 10 credits)

(b) Air cooled Chilled-Water Plant/ Unitary Air-Conditioners (DX CRAC Units):

Air-cooled Chilled-Water plant:

- Air-Cooled Chiller
- Chilled Water Pump

Unitary Air-Conditioners:

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

Baseline Prerequisite Requirements	Peak Cooling Load	
	< 500 RT	≥ 500 RT
Minimum water-cooled central chilled-water plant efficiency	1.1 kW/RT	1.0 kW/RT

Note:
Stricter minimum performance applies for Silver and higher ratings (see pre-requisite requirements)

(c) Using chilled water from a central facility (e.g. district cooling system or central chilled water plant not operated solely to serve the data centre)

For data centres using district cooling system, data from the central plant will be used for the computation of the cooling system performance.

Note:
Combination of system types
Where there is a combination of system types, the computation of the credits awarded will be pro-rated based on the actual cooling capacity supplied by each system type, or by the operating hours, if the different systems are not operating at the same time**.**

(d) Air Management System:

Computer Room Air-Conditioning Units (CRACs) and Computer Room Air-Handling Units (CRAHs)

Baseline – Fan power limitation in AC system

Baseline Air Distribution System Type	Allowable Fan System Input Power	
	($kW/m^3/s$)	(W/CMH)

(b) Air Cooled Chilled-Water Plant/ Unitary Air-Conditioners

Peak data centre cooling load < 500 RT

7credits for meeting the prescribed air-conditioning system efficiency of 1.1 kW/ton

0.1 credits for every percentage improvement in the air-conditioning system efficiency better than 1.00 kW/ton

Credits scored = 7 + (0.1 x % improvement)

Peak data centre cooling load ≥ 500 RT

7 credits for meeting the prescribed air-conditioning system efficiency of 1.0 kW/ton

0.125 credits for every percentage improvement in the air-conditioning system efficiency over the baseline
Credits scored = 7+ (0.125 x % improvement)

(Up to 10 credits)

(c) Using chilled water from a central facility

Credits in accordance with above based on central plant data.

If no data is available,
5 credits will be applied.

(d) Air Management System

0.1 credit for every percentage improvement in the air distribution system efficiency over the baseline

(Up to 4 credits)

AHUs / FCUs ≥ 4kW (Constant Volume)	1.5	0.42
AHUs ≥ 4kW (Variable Volume)	2.1	0.58
Fan systems with nameplate motor power < 4kW	0.6	0.17

(ii) 1-2-2 Electrical System

To have the most efficient electrical power supply system providing the required level of redundancy while maintaining high load factors.

Building transformer loss value shall be based on measuring the loss across the building transformers that is supporting the data centre operation and comply with requirements in MS-1525:2019.

Provision of energy efficient UPS (uninterrupted power supply)

1 credit

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 2 credits)

The IT power chain efficiency includes transmission lines, switchgear, UPSs and PDUs serving the IT equipment. Efficiencies higher than the baseline (minimum) efficiency, as shown in the table below, depending on the UPS load factor, will qualify for additional points. Values between the UPS Load Factors indicated in the table will be linearly interpolated.

UPS Load Factor	Minimum IT Power Chain Efficiency
25 %	73 %
33 %	78 %
50 %	83 %
66 %	85 %
75 %	86 %
100 %	88 %

The UPS Load Factor shall be determined as:

UPS Load Factor = Total UPS Output / Total Installed UPS Capacity (N)

The IT Power Chain Efficiency shall be determined from a separate calculator to be provided, based on switchgear, UPS and PDU selection and their system configuration.

4 credits for achieving minimum efficiency

0.5 credits for every 2% improvement in efficiency over the minimum.

(Up to 6 credits)

(iii) 1-2-3 IT Equipment To have policies that require the procurement and use of the most efficient ICT equipment which meet the demand, while providing the required level of redundancy. (i) ICT equipment, including servers, storage devices and network systems, that are Energy STAR or equivalent rated, where available. (ii) Power control of ICT equipment. Low power modes, Power capping (minimum 25% of the equipment enabled). (iii) Software control technologies, such as virtualization and optimizing algorithms or dynamic control of equipment for minimizing energy utilisation. (iv) Monitoring of ICT or Server Equipment Utilisation.	2 credits 2 credits 2 credits 2 credits Note: The section EDC 1-2-3 is applicable only to data centres that have operational control over the ICT equipment.
EDC 1-3 ENERGY EFFICIENCY AND PERFORMANCE VERIFICATION **(i) 1-3-1 Energy Assessment and Energy Audit** The data centre should have a systematic process in developing an understand of the operation of the building's major energy using system options for optimizing energy performance and a plan to achieve energy savings. The assessment process shall include: • Energy assessment of data centre space using DC assessment tools • Energy audit of non-data centre space • Performing a savings and cost analysis of all practical energy saving measures according to the company's constraints and economic criteria, along with the discussion of any effect on operations and maintenance procedures.	2 credits

• Documenting the energy analysis and potential cost-effective energy savings solutions The audit shall verify the systems are: • Installed, calibrated, and perform according to the requirements, basis of design and construction documents • Performing at multiple load points according to design criteria during normal utility operations, maintenance operations and failure conditions • Giving the correct measured PUE according to design criteria at the current load and the calculated PUE at full load conditions	1 credit
(ii) 1-3-2 Building Management System The data centre should have a computer-based building management system (BMS) to provide information to support the ongoing accountability and optimization of data centre energy performance and identify opportunities for additional energy-saving investments. The BMS shall monitor and control major building systems, including at a minimum, central cooling and heat rejection, ventilation, lighting and IT power transformation and distribution and IT equipment rack environmental conditions The BMS shall also support the: • Continuous monitoring and trend logging of significant energy systems • Establishment of seasonal profiles to determine the potential for the use of free and partial free-cooling. • Diagnostics within the control system to alert the staff when equipment is not being optimally operated.	2 credits
(iii) 1-3-3 Energy Metering and Reporting of PUE (a) Data centre PUE metric from all energy sources should be measured and trended over time; so that the data centre owner and/or operator can verify	1 credit

that the energy related systems are performing according to the basis of design. The data centre shall, at a minimum, be equipped with energy metering to provide total facility power and energy usage and total IT equipment power and energy usage on a historical basis, in order to determine instantaneous and average PUE data. (b) Besides PUE determination, the data centre shall be equipped with energy metering to provide power and energy usage for the facility's power transformation and distribution systems, cooling systems and any on-site generation and trending of these metrics on a historical basis. This will enable the data centre operator to verify that the building's energy related systems are performing according to the design energy efficiency performance at both partial load and full-load conditions. The number and type of meters that are required to be installed shall be determined by the data centre design, but shall be maximum 2% uncertainty, full scale and provided to meter all forms of energy to the data centre, (electricity, natural gas, steam, chilled water, one-pass cooling, etc.) and at the output of the UPS or PDUs, if this is the source of power that serves the IT equipment. Meters must be calibrated to within the manufacturer's recommended range.	2 credits
(c) **Prerequisite requirements**: 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 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 M&V instrumentation.	2 credits

• Location and installation of the measuring devices to meet the manufacturer's recommendation. • Data acquisition system shall be able to record and store values up to at least 3 decimal places. • All data logging with capability to trend at 1-minute sampling time interval. • 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 and shall have an end- to-end measurement uncertainty not exceeding ±0.05°C over entire measurement or calibration range. 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 two spare thermo-wells located at both side of the temperature sensor for verification of measurement accuracy. • 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.	
EDC 1-4 ENERGY POLICY AND MANAGEMENT **1-4-1 Data Centre Operations and Energy Management** Have policies that promote continuity of information to ensure that energy-efficient operating strategies are maintained; and provide a foundation for training and system analysis.	2 credits

Obtained ISO 50001 certification, including intent, measures and implementation strategies of energy efficiency improvement plans to achieve energy target set over the next three years. (Required for Platinum and Gold rating)	3 credits
EDC 1-5 ENERGY EFFICIENT FEATURES AND INNOVATIONS Encourage the use of innovative energy efficient equipment, system or design features. To qualify, the features must achieve significant, measurable improvement of energy performance in one of the following areas: (a) Innovative cooling systems or features (including free air-cooling, direct liquid cooling and two-phase systems, etc.) (b) Innovative power supply, back-up power or UPS systems (c) IT operations, maintenance or system upgrade strategies not covered by Section EDC 1-2-3 (d) Radical changes in data centre design, operations or systems not covered in any section above.	2 credits for each innovation that demonstrate the following: • The intent of the proposed innovation • The additional energy benefits delivered • The proposed requirements for compliance • The proposed performance metrics to demonstrate compliance and the approaches (strategies) used to meet the requirements (Up to 8 credits)
EDC 1-6 RENEWABLE ENERGY Encourage the use of renewable energy to offset facility energy demands. (a) Solar feasibility study – to assess the data centre's potential and viability to harness and leverage on solar energy and photovoltaics solution(s) adoption. (b) Solar ready roof - Appropriate roof pitch, static loads, mounting system and roof access to be considered. (c) Adoption of renewable energy – Incorporation of renewable energy to reduce building's energy consumption from grid and corresponding carbon emission.	1 credit 1 credit 1 credit for every 0.1% replacement of total building energy consumption with renewable energy or

	1 credit for every 25% of roof area used for solar panels (up to 3 credits)
PART 1 – ENERGY EFFICIENCY CATEGORY SCORE:	Sum of GreenRE credits obtained from EDC 1-1 to 1-6: Maximum 86 Credits

Part 2 - Water Efficiency	GreenRE credits
EDC 2-1 WATER EFFICIENT DESIGN (a) Provide private-metering and potable water leak detection system for better control and monitoring, such as: (i) To monitor the water consumption on monthly basis (ii) Provision of private-meters for major water uses (e.g. cooling towers) (iii) Linking all private-meters to the Building Management System (BMS) for leak Detection	2 credits
(b) To specify the use of water efficient fittings under Water Efficiency Product Labelling Scheme (WEPLS) or equivalent for all applicable water fittings.	1 credit
(c) Establish baseline water consumption performance and targets for improvements over the baseline. To show intent, measures and implementation strategies of water efficiency improvement plans over the next three years. Committed water savings accrued from proposed measures should be quantified.	1 credit
EDC 2-2 ALTERNATIVE WATER SOURCES Use of suitable systems that utilize alternative water sources for **non-potable uses**: cooling tower make up water, irrigation, washing, water features, toilet flushing, etc. to reduce use of potable water. Alternative sources can include rainwater, greywater (for toilet flushing only), condensate harvesting from the cooling system and recycled water from approved sources.	Credits awarded based on calculated % reduction in potable water usage of the applicable uses > 50 % - 3 credits < 10 % to 50 % - 2 credits < 10 % - 1 credit (Up to 3 credits)

EDC 2-3 COOLING TOWER WATER USE Calculate percentage savings over baseline annual consumption. The baseline consumption is calculated based on the following: (a) Evaporation rate of 1% water flow rate for each 7 Kelvin of water temperature range, (b) Drift loss of 0.002% water flow rate for counter-flow towers and 0.005% water flow rate for cross-flow towers, and (c) Use of cooling tower water treatment system which can achieve 7 or better cycles of concentration of acceptable water quality	Credits awarded based % saving over baseline. > 50 % - 6 credits > 30 % - 4 credits (up to 6 credits) Note: Section NDC 2-3 is applicable only to data centres using water-cooled systems
PART 2– WATER EFFICIENCY CATEGORY SCORE:	Sum of GreenRE credits obtained from EDC 2-1 to 2-3: Maximum 13 Credits

<table>
<tr><th>Part 3 – Sustainable Operations & Management</th><th>GreenRE credits</th></tr>
<tr><td><u>EDC 3-1 REFRIGERANTS AND FIRE SUPPRESSANTS</u>

To reduce global warming and damage to the ozone layer by minimising the release of greenhouse gases and ozone depleting substances.

(a) Use Refrigerants with ozone depletion potential (ODP) of zero or with global warming potential (GWP) of less than 100.

(b) Refrigerant leak detection monitoring system at critical areas of plant rooms containing chillers and other equipment with refrigerants.

(c) In server rooms, use of Fire Suppressants with zero ODP or GWP of less than 100.

(d) In UPS and Battery rooms, use of Fire Suppressants with zero ODP or GWP of less than 100.</td><td>1 credit

1 credit

1 credit

1 credit</td></tr>
<tr><td><u>EDC 3-2 SUSTAINABLE PRODUCTS</u>

Encourage the use of building components / products certified by an approved certification body.

Recycled components / products with third party verification.</td><td><table><tr><th>Extent of use of environmentally friendly product</th><th>Weightage for Credit Allocation</th></tr><tr><td>Low Impact</td><td>0.5</td></tr><tr><td>Medium impact</td><td>1</td></tr><tr><td>High Impact</td><td>2</td></tr></table>
Credits scored will be based on the extent of use of environmentally friendly product.

(Up to 6 credits)</td></tr>
<tr><td><u>EDC 3-3 SUSTAINABILITY POLICY</u>

<u>3-3-1 Sustainable Purchasing & Operation</u>

Adoption of sustainable and environmental-friendly procurement and purchasing policy in the operation and maintenance of the building.

<u>3-3-2 Waste Management</u>

(a) Adoption of waste management policy to promote and encourage waste minimization</td><td>1 credit

1 credit</td></tr>
</table>

(b) Adoption of waste management policy to promote waste sorting, collecting, quantifying, monitoring and recycling of a large range of waste generated in-house. Provide facilities or recycling bins for collection and storage of different recyclable waste such as: 1. IT related waste such as, electronic equipment 2. Plastic waste 3. Metal waste 4. Paper waste	1 credit
EDC 3-4 ENVIRONMENTAL MANAGEMENT PRACTICE Encourage the adoption of environmentally friendly practices during construction and building operation. (a) A green guide for the occupants or visitors should be disseminated through various channels. Best practices to reduce energy use, water use and maintain a good indoor environment should be documented in this green guide. To demonstrate evidences of occupant involvement in environmental sustainability. (b) Main builder that has good track records in the adoption of sustainable, environmentally friendly and considerate practices during construction. (c) Developer, main builder, M&E consultant and architect are ISO 14000 certified. (d) Project team comprises one Certified GreenRE Manager / Greenmark Accredited Professional (GMAP)	1 credit 1 credit 0.25 credit for each firm (Up to 1 credit) 1 credit for certified GRM/GMM
PART 3 – SUSTAINABLE OPERATIONS & MANAGEMENT CATEGORY SCORE:	Sum of GreenRE credits obtained from EDC 3-1 to 3-4: Maximum 17 Credits

Part 4 – Indoor Environmental Quality	GreenRE credits
EDC 4-1 INDOOR AIR QUALITY (IAQ) MANAGEMENT	
(a) Pre-requisite requirement: To conduct full IAQ audit once in three (3) years that complies with Code of Practice on Indoor Air Quality, Department of Occupational Safety and Health, Ministry of Human Resources Malaysia (2005) for occupied areas.	2 credits
(b) Implement effective IAQ management plan to ensure building ventilation systems are frequently maintained to ensure clean delivery of air.	1 credit
(c) Use of high efficiency air filter (at least MERV 8) in AHU to reduce indoor contaminants and provide good protection for cooling coil and reducing frequency or eliminating duct cleaning	1 credit
(d) Room Temperature display (at least 1 unit per floor)	1 credit
(e) Additional carbon dioxide sensor display (at least 1 unit per floor)	1 credit
EDC 4-2 LIGHTING QUALITY AND MANAGEMENT	
To encourage good lighting design to promote productivity and occupant comfort.	Extent of Coverage: At least 90% of all applicable areas that are served by fluorescent luminaries
Improve lighting quality by avoiding low frequency flicker associated with fluorescent lighting with the use of high frequency ballasts in the fluorescent luminaries.	1 credit
Use of driver with output frequency < 200Hz and < 30% flicker for LED lighting.	1 credit
NDC 4-3 THERMAL COMFORT AND NOISE LEVEL	
(a) In all areas specify comfort level to comply with the following: • Supply air temperature not less than 23°C • Relative Humidity between 30% to 60%	1 credit
(b) All areas are designed to achieve ambient internal noise level as specified: • 55 dB (6am – 10pm) L_{Aeq} • 45 dB (10pm – 6am) L_{Aeq}	1 credit
PART 4– INDOOR ENVIRONMENTAL QUALITY CATEGORY SCORE:	Sum of GreenRE credits obtained from EDC 4-1 to 4-3: Maximum 10 Credits

Part 5 – Other Green Features	GreenRE credits
EDC 5-1 GREEN FEATURES AND INNOVATIONS To encourage the use of other green features which are innovative or/and have positive environmental impact. Features must achieve significant, measurable environmental performance in the data centre operations, maintenance or management not covered in Part 2, 3 and 4 above. Examples: (a) Computational fluid dynamics (CFD) simulation to analyse and improve air management inside data halls (b) Building Information Modelling (BIM) based design such as 4D, 5D, 6D (c) Purchase green power generated locally for a minimum contract period of 10 years. (0.5 credits for every 1% replacement) (d) PUE less than 1.4 at 33% IT load – refer to PUE calculation formula (e) Thermal mapping of racks to identify areas of overcooling and undercooling	Credits awarded for each feature based on impact and demonstration of the following: • The intent of the proposed innovation • The additional environmental benefits delivered • The proposed requirements for • Compliance • The proposed performance metrics to demonstrate compliance and the • approaches (strategies) used to meet the requirements (Up to 10 credits) 2 credits 1 credit each up to 10 credits 3 credits 1 credit
PART 5 – OTHER GREEN FEATURES CATEGORY SCORE:	Sum of GreenRE credits obtained from EDC 5-1: Maximum 10 Credits

Part 6- Carbon Footprint of Development	GreenRE Credits
EDC 6-1 CARBON FOOTPRINT OF DEVELOPMENT To calculate Scope 1, 2 and 3 emissions in accordance with established Green House Gas (GHG) Protocol aligned frameworks. For new buildings, this will primarily entail direct and indirect operational emissions (Scope 1, 2) and embodied carbon from construction and materials used. (Scope 3).	3 credits
PART 6- CARBON FOOTPRINT OF DEVELOPMENT **CATEGORY SCORE:**	Sum of GreenRE credits obtained from EDC 6-1: Maximum 3 Credits

GreenRE Score (Existing Data Centre)

GreenRE Score (EDC) = ∑Category score [(Part 1-Energy Efficiency) +
(Part 2-Water Efficiency) +
(Part 3-Sustainable Construction & Management) +
(Part 4-Indoor Environmental Quality) +
(Part 5-Other Green Features) +
(Part 6-Carbon Emission of Development)]

Where:
Category Score for Part 1≥ 35 credits and
∑Category score for Part 2 to Part 6 ≥ 10 credits