TECHNICAL CODE

SPECIFICATION FOR GREEN DATA CENTRES

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DEVELOPMENT OF TECHNICAL CODES

The Communications and Multimedia Act 1998 ('the Act') provides for Technical Standards Forum designated under section 184 of the Act or the Malaysian Communications and Multimedia Commission ('the Commission') to prepare a technical code. The technical code prepared pursuant to section 185 of the Act shall consist of, at least, the requirement for network interoperability and the promotion of safety of network facilities.

Section 96 of the Act also provides for the Commission to determine a technical code in accordance with section 55 of the Act if the technical code is not developed under an applicable provision of the Act and it is unlikely to be developed by the Technical Standards Forum within a reasonable time.

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VADS Data Centre Network

FOREWORD

This technical code for the Specification for Green Data Centres (this 'Technical Code') was developed pursuant to section 185 of the Act 588 by the Malaysian Technical Standards Forum Berhad (MTSFB) via its Technical Experts Group (TEG) on Green Data Centres under the supervision of Green ICT Working Group.

This Technical Code was developed to provide the minimum requirements for green data centres for the purpose of establishing policies, systems and processes to improve the energy efficiency of data centres and at the same time reducing the carbon footprint of the industry.

This Technical Code also outlines the best practices which are described in Annex A that data centres should adopt in achieving a sustainable industry.

This Technical Code shall continue to be valid and effective until reviewed or cancelled.

MCMC MTSFB TC G004:2015

SPECIFICATION FOR GREEN DATA CENTRES

1. Introduction

In 2011, Malaysia's ICT industry spent RM3.57 billion on electricity and emitted 7.14 million metric tons of CO_2. Based on international industry averages, the data centre segment is responsible for 20% of the industry's energy consumption and carbon footprint making data centres a key focus area for energy efficiency and carbon reduction efforts. As it currently stands, data centres in Malaysia contributed some 1.4 million metric tons of CO_2 in 2011 and spent close to RM714 million on energy bills.

As such, there is an urgent need for guidance for data centres operating in Malaysia to reduce operating costs and lessen its impact on the environment as we strive towards establishing a low carbon economy by 2020.

The development of this Technical Code is one in an array of efforts to provide the guidance required by private, government and commercial data centres. Certification is not a mandatory requirement and organisations can choose to be certified voluntarily. The primary objectives of this Technical Code are to establish policies, systems and processes to improve the energy efficiency of data centres. This in turn will result in a reduction of the facility's operating costs and carbon footprint. It also serves to enhance the competitiveness of Malaysia's data centre industry and at the same time prevent various forms of greenwashing. Moving forward, as regulations are becoming increasingly prevalent worldwide for enforcing controls on top polluting industries, this Technical Code will be the basis for reference once these regulations are in place here in Malaysia.

Businesses, government and society derive multiple benefits of having this Technical Code which provides requirements, specifications, guidelines or characteristics that can be used consistently. Businesses stand to gain from cost savings, increased customer satisfaction, new markets and greater than before market share. Government benefits from expert opinion and is able to participate effectively in globalisation. Society enjoys an improved quality of life of various facets.

2. Scope

This Technical Code provides the minimum requirements for green data centres for the purpose of establishing policies, systems and processes to improve the energy efficiency of data centres and at the same time reducing the carbon footprint of the industry.

This Technical Code also outlines the best practices that data centres should adopt in achieving a sustainable industry.

This Technical Code covers all private and public data centres operating in Malaysia, either private or commercial. Within a data centre, the following areas are covered namely environmental conditions, energy management, air management, cooling management, IT equipment and lighting, power chain management, space management, information management, governance and guidelines.

3. Normative References

The following normative references are indispensable for the application of this Technical Code. For dated references, only the edition cited applies. For undated references, the latest edition of the normative reference (including any amendments) applies.

ANSI/TIA/EIA-942 - *Data Center Design Guidelines and Structure Cabling Standards*

ENERGY STAR® Program Requirements Product Specification for Computer Servers, Eligibility Criteria, Final Draft Version 2.0, published in 2013

ITU-T REC-L.1300, *Best practices for green data centres*

MS ISO 50001, *Energy Management System*

New Data Center Energy Efficiency Evaluation Index - DPPE (Datacenter Performance per Energy) Measurement Guidelines, (Version 2.05), Green IT Promotion Council, published in 2012

Self-benchmarking Guide for Data Center Infrastructure: Metrics, Benchmarks, Actions, Lawrence Berkeley National Laboratory, published in 2010

The Green Data Centre: Achieving the True Potential of Sustainable Computing, a joint research report by the Ministry of Energy, Green Technology and Water Malaysia and the Green Computing Initiative, published in 2012.

Thermal Guidelines for Data Processing Environments – Expanded Data Center Classes and Usage Guidance, American Society of Heating, Refrigerating and Air Conditioning Engineers, published in 2011

WP49-PUE, *A Comprehensive Examination of the Metric Version 6, Green Grid,* published in 2012

4. Abbreviations

For the purposes of this Technical Code, the following abbreviation applies.

ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
CRAC	Computer Room Air Conditioning
CRAH	Computer Room Air Handling
DB	Distribution Board
DX	Direct Expansion
EnMS	Energy Management System
EnPI	Energy Performance Indicator
GDC	Green Data Centre
GDCMS	Green Data Centre Malaysia Standards
HT	High Tension
HVAC	Heating, Ventilation and Air Conditioning
KVM	Kernel based Virtual Machine
kW	Kilowatt
MSB	Main Switch Board
PDU	Power Distribution Unit
PUE	Power Usage Effectiveness
RHR	Relative Humidity Range
SAT	Supply Air Temperature
SLA	Service Level Agreement
SSB	Sub-switch Board
TCO	Total cost of ownership

ULF	UPS Load Factor
UPS	Uninterruptible Power Supply
USE	UPS System Efficiency
VSD	Variable Speed Drives

5. Minimum Requirements

5.1 Measurements

Measurements are indicators of a system's performance that can be observed, individually or jointly, while executing scenarios. These are directly measurable and can be collected automatically. The following measurements are to be used in benchmarking the minimum requirements of a green data centre.

5.1.1 Power Usage Effectiveness (PUE)

PUE is an efficiency measurement comparing a data centre's infrastructure to its existing IT load. The initial benchmarking of PUE yields an efficiency score and sets a testing framework for the facility to repeat. The formula for the calculation of PUE is the total facility power divided by the IT equipment power. Total facility power is derived by combining the power for the facility power serving to the Data Centre (excluding offices, conference rooms, meeting rooms), energy management system, HVAC (heating, ventilation, and air conditioning) and physical security measured at the MSB/SSB/DB level. Total IT power is derived by combining the power for compute devices, network devices, IT support systems, storage, telecommunications equipment and miscellaneous devices measured at the PDUs level.

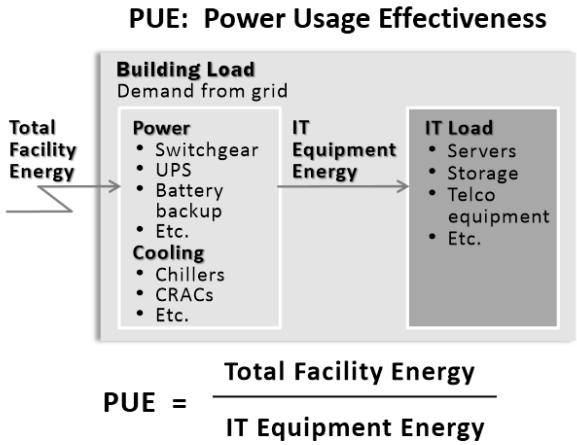

Figure 1. PUE measurement description

IT equipment energy includes the energy associated with all of the IT equipment (e.g. compute, storage, and network equipment) along with supplemental equipment (e.g. KVM switches, monitors and workstations/laptops used to monitor or otherwise control the data centre).

Total facility energy includes all IT equipment energy as described above plus everything that supports the IT equipment using energy, such as: Power delivery components, including UPS systems, switchgear, generators, PDUs, batteries, and distribution losses external to the IT equipment; cooling system components, such as chillers, cooling towers, pumps, CRAHs units, CRACs units, and DX air handler units and other miscellaneous component loads, such as data centre lighting.

The IT load is measured at the output of the PDU equipment. The incoming energy is measured from the utility service entrance after the HT transformer that feeds all of the electrical and mechanical equipment used to power, cool, and condition the data center. Basic monitoring requires, at a minimum, the collection of power measurements once a month; for energy measurements, that frequency is recommended.

The following Table 1 denotes the classification of the derived PUE measurement. The minimum PUE measurement shall be 1.9.

Table 1. Classification of the derived PUE measurement

Minimum	Good	Excellent
1.9	Less than 1.9 and more than 1.6	Less than or equal 1.6

5.1.2 Supply Air Temperature (SAT)

SAT is a measurement that represents the airflow weighted average of the supply air temperature in the data centre. A low supply air temperature indicates the potential for improving a data centre's air management and increase the supply air temperature. Higher supply air temperatures allow HVAC cooling systems to operate more efficiently. The metric is derived by measurement at measuring aisle temperature at 1.5 meters above the floor at rack level, establish at least one point for every 3-6m of aisle or every fourth rack position.

The measurement for SAT shall be no lower than 23°C.

5.1.3 Relative Humidity Range (RHR)

RHR is a measurement which covers the range of the IT equipment inlet air humidity set points. A small relative humidity set point range suggests opportunities to reduce energy use, by reducing the active humidification and dehumidification. Centralized active control of the humidification units reduces conflicting operations between individual units, thereby improving the energy efficiency.

The measurement is derived by establishing a range based on low end IT equipment inlet air relative humidity set point and high end IT equipment inlet air relative humidity set point. Measurement is at 1.5 meters above the floor at rack level, establish at least one point for every 3-6m of aisle or every fourth rack position.

The measurement for RHR shall be between 30% to 60%.

5.1.4 UPS System Efficiency (USE)

The USE metric is the ratio of the UPS output power to the UPS input power. The UPS efficiency varies depending on its load factor. USE is derived by dividing UPS output power (kW) with UPS input power (kW) and then multiplying by 100.

The measurement equation is:

USE = (UPS output power (kW) / UPS input power (kW)) x 100

The UPS efficiency varies depending on its load factor and therefore the benchmark for this metric depends on the ULF of the UPS system. The ULF metric is the ratio of the peak load of the uninterruptible power supply (UPS) to the design value of its capacity. This provides a measure of the

UPS system over-sizing and redundancy. The measurement is derived by dividing UPS average load (kW) with UPS peak load capacity (kW).

The measurement for USE shall be 90% or higher.

5.2 Policy

5.2.1 Competence and Training

The organization shall ensure that any person(s) working for or on its behalf, related to GDC implementation and operation are required to obtain appropriate education, training, skills or experience to be competent. The training and certification is required to be locally recognized by the government. The organization shall identify and provide training associated with GDC implementation and operation. Appropriate records shall be maintained.

5.2.2 Communication and Awareness

The organization shall communicate and ensure that any person(s) working for or on its behalf are aware of:

a) The importance of conformity with the policy procedures and the requirements of the GDCMS;
b) Their roles, responsibilities and authorities in achieving the requirements of the GDCMS;
c) The benefits of improved Green Data Centre performance;
d) The impact, actual or potential, with respect to Green Data Centre implementation and operation, of their activities and how their activities and behavior contribute to the achievement of its objectives and targets, and the potential consequences of departure from specified procedures.

The organization shall establish and implement a process by which any person working for, or on behalf of, the organization can make comments or suggest improvements to the GDCMS. The organization shall decide whether to communicate externally about its policy, GDCMS performance, and shall document its decision. If the decision is to communicate externally, the organization shall establish and implement a method for this external communication.

5.2.3 Expertise

The organizations are advised to encourage their relevant personnel to obtain locally government recognised certification with regards to GDC operations.

5.2.4 Design

The organization shall consider GDC requirements improvement opportunities and operational control in the design of new, modified and renovated facilities, equipment, systems, space management, location and processes that can have a significant impact on its performance.

The results of the performance evaluation shall be incorporated where appropriate into the specification, design and procurement activities of the relevant project(s). The results of the design activity shall be recorded.

5.2.5 Governance and Regulatory

The organization shall identify, implement, and have access to the applicable legal requirements and other requirements to which the organization subscribes related to its GDC implementation and efficiency. The organization shall determine how these requirements apply to its implementation and efficiency and shall ensure that these legal requirements and other requirements to which it subscribes are considered in establishing, implementing and maintaining the GDC

Legal requirements and other requirements shall be reviewed at defined intervals. The organization shall evaluate compliance with legal requirements and other requirements to which it subscribes related to its GDC implementation. Records of the results of the evaluations of compliance shall be maintained.

The organization shall address actual and potential nonconformities by making corrections, and by taking corrective actions, preventive actions and reviewing its effectiveness. The organization shall review the organization's GDCMS to ensure its continuing sustainability, adequacy and effectiveness. The organization shall establish and maintain records, as necessary, to demonstrate conformity to the requirements of any applicable international standards.

5.2.6 Purchasing

The organization shall take into consideration the impact on GDC implementation and operation when purchasing IT equipment (hardware and software), electrical and mechanical equipment. The organization shall establish, implement and maintain a procedure(s) to identify the environmental aspects when purchasing the IT equipment (hardware and software), electrical and mechanical equipment for GDC implementation and operation.

The organization shall determine those aspects that have or can have significant impact(s) on the environment (i.e. significant environmental aspects). The organization shall document this information and keep it up to date.

The organization shall establish and implement the criteria prior to the purchasing of the IT equipment (hardware and software), electrical and mechanical equipment which are expected to have a significant impact on the organization's energy performance. The organization shall define and document the purchasing specifications, as applicable, for effective GDC implementation and operation.

5.3 Monitoring

5.3.1 Energy Metering

The data centre shall install metering equipment capable of measuring

a) the total energy use of the data centre, including all power conditioning, distribution and cooling systems. The measured energy shall be separate from any non-data centre building loads; and
b) the total energy delivered to ICT systems, including power distribution units including other power feeds where non UPS protected power is delivered to the racks.

5.3.2 Energy Reports

Energy use and environmental (temperature and humidity) data shall be reported on an annual basis.

Energy use of the ICT equipment (Server, Network, Storage) shall be reported on an annual basis.

6. Energy Management System (EnMS)

The organization shall:

a) Establish, document, implement, maintain and improve an EnMS in accordance with the requirements of MS ISO 50001;
b) Define and document the scope and boundaries of its EnMS; and
c) Determine how it will meet the requirements of MS ISO 50001 in order to achieve continual improvement of its energy performance and of its EnMS.

7. Green Data Centre Best Practices

The organisation should emulate the recommended best practices as outlined in Annex A which describes recommendations for various components within a data centre comprising of civil and structure, mechanical, electrical, information technology and monitoring and control.

Annex A
(Informative)

Green Data Centre Best Practices

Table A1. Civil and Structure

Recommendation	Description
CS1. Internal space management within data centre	Provisioning of space based on actual utilised data centre white space(with power & cooling) and not reserved space
	Implement phased approach in capacity provisioning (on demand basis)
CS2. External data centre building	Building Facility: Data centre building in accordance to sustainability standards in terms of reduce, reuse, recycling, land/environmental impact and consumption of natural resources in the design and build process
CS3. Operational resilience	Centralized view of resilience across all M&E and IT components including understanding of all upstream and downstream relationships
	Matching data center resilience to SLA between Operations and Business Units
CS4.Lighting	Reduce the energy consumption of lighting equipment
	Utilise occupancy sensors and where lighting technologies are installed use components with a lower energy consumption, greater quality of light, longer lifespan and from recyclable components
CS5.Fire Suppression	Utilise an eco-friendly and sustainable fire suppression gas

Table A2. Mechanical

Recommendation	Description
M1. Air Flow	Implement hot and cold aisle layout
	Implement containment or enclosures
	Install blanking panels
	Deploy optimally placed diffusers
	Deploy structured cabling.
	Install floor grommets
M2. HVAC	Server inlet temperature adjustments based on ASHRAE guidelines
	Humidity adjustments based on ASHRAE guidelines
	Deploy CRAC / CRAH with VSD or EC Fans
	Utilise an eco-friendly and sustainable refrigerant

Table A3. Electrical

Recommendation	Description
E1. Energy Management	Scalable power infrastructure(modularity)
	Document and participate in the recycling plans for batteries and other consumables
	Align racks depending on power density
	Use monitoring software data and other tools to implement real time changes (phase balancing, load changes, etc)
	Alternative method of backup power for the data center based on TCO, environmental and sustainability considerations
	Utilise high efficiency UPS

Table A4. Information Technology

Recommendation	Description
IT1. ICT equipment consolidation	Implement server virtualization
	Decommissioning of unused servers
	Consolidation of lightly utilized servers
	Better management of data storage
IT2. Green procurement	Procure assets that comply with reducing hazardous substances and are recyclable
	Procure energy efficient equipment that comply with Energy Star or similar standards and metrics
	TCO modelling includes power consumption of the component at the expected/actual utilization levels
	Cradle to cradle lifecycle view on all M&E and IT equipment - looking at embedded carbon, ease of recycling of the product, etc.
IT3. IT equipment lifecycle extension	Hardware refresh policy set based on TCO model including typical operating cost, capital cost, depreciation costs and value of new technology
	Decommissioning servers based on compute characteristics (e.g.CPU utilization, Memory I/O)
	Optimize server configuration based on resource usage
IT4. E-Waste	Reuse policy for assets across the organization
	E-Waste vendor in place to deal with all data centres equipment aligned to local/national mandatory regulations
	E-Waste strategy in place to promote reselling, recycling, donating and disposal of IT assets based on cost, legislation, ethical and sustainable implications across all data centres
	Supplier and supply chain evaluated for waste management and environmental protection practices
	Supplier and supply chain waste & environmental compliance programs included as part of procurement/sourcing decision process

Table A5. Monitoring and Control

Recommendation	Description
MC1. Monitoring and control	Centralized and automated monitoring system inclusive of all mechanical, electrical and facility systems
	Holistic monitoring capability across the data center - from source of power to chip performance
	PUE Level measured, plan and actions in place for improvements
	Automated analysis/reporting of data to identify energy saving opportunities
	IT and Facilities collaboration on unified energy efficiency goals

Acknowledgements

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