Singapore's Green Data Centre Roadmap

Carving a Route for a Sustainable Digital Future

Introduction

On 30 May 2024, at the ATxSummit, Deputy Prime Minister Mr Heng Swee Keat launched the Green Data Centre ("**DCs**") Roadmap ("**Roadmap**") to guide digital sustainability and to chart green growth pathways for DCs. Under the Roadmap, at least 300 megawatts ("**MW**") of additional DC capacity will be provided, with the possibility of achieving additional capacity through the use of green energy. The possible 300-and-more MW is expected to significantly add to the existing 1.4 gigawatts of computing capacity in Singapore, with an added emphasis on energy efficiency, use of green (low-carbon) energy and water usage targets, and an emphasis on industry partnerships as catalysts.

The challenge of managing DCs' resource footprint, while a global one, is augmented within Singapore as a compact microcosm. The ability to expand DCs' capacity in a sustainable manner will depend on the ability to make DCs green. Singapore, applying its advantage as a regional data centre hub and a dynamic international business hub, is taking the lead in crafting innovative strategies for the long-term sustainable growth of DCs through the Roadmap.

The Roadmap advances the work of the Digital Connectivity Blueprint launched in June 2023 that sets out Singapore's ambition for a future-ready and world class digital infrastructure. The Roadmap outlines Infocomm Media Development Authority's ("**IMDA**") plans to partner the industry to innovate and accelerate DCs' sustainability, while recognising that the pathways to be taken would be exploratory and require shared commitment. The Roadmap is therefore a living document and pioneers an ecosystem approach to push the boundaries to meet a sustainable digital future.

This Update highlights (i) the Roadmap's key recommendations; (ii) the steps that players in the DC ecosystem should start implementing to achieve the energy efficiency and water usage targets that will become applicable over the next 10 years; and (iii) the Government grants and other assistance available to support the move to a sustainable digital future.

As the Deputy Prime Minister indicated, "[t]o encourage adoption of the Roadmap, IMDA and EDB will allocate new data centre capacity to operators which prioritise both sustainability and economic value."[1]

Adopting sustainable operations and practices are no longer optional, they are a necessity and a competitive advantage.

[1] Speech by Deputy Prime Minister Heng Swee Keat at the Asia Tech x Singapore (ATxSG) 2024 opening ceremony on 30 May 2024.

Greener Data Centres

Developed with industry input, the Roadmap charts the foundation for a sustainable pathway for the continued growth of DCs in Singapore.

Energy Efficiency

A DC's energy efficiency improvement can be targeted in several areas, especially the facility level and the compute/information technology ("**IT**") equipment level, which encompasses the full hardware and software stack.

(a) Facility level energy efficiency

Adopting energy efficient systems and equipment, and optimising their configuration and operation, can improve facility level energy efficiency. Over the next 10 years, IMDA aims for all DCs in Singapore to achieve Power Usage Effectiveness ("**PUE**") of less than or equal to 1.3 at 100% IT load. The table below summarises the Roadmap's recommendations for DCs to improve facility level energy efficiency.

Recommendations	Energy Efficiency Benefits	Available Government Support
Upgrade mechanical and electrical engineering equipment ("M&E") with energy-efficient retrofits and upgrades for key equipment	• Reduces energy consumption of supporting infrastructure	DC operators can tap on support schemes such as Economic Development Board's: • Enhanced Resource Efficiency Grant for Emissions (REG(E)) • Investment Allowance for Emissions Reduction (IA(ER)) Refreshed Green Mark for Data Centre by end-2024, in partnership with Building and Construction Authority,
Apply tropical DC methodology	• Safely raise the DC operating temperature for energy efficiency gains	
Tailor cooling solutions to meet DCs' needs	• Air cooling alone can support racks with rack density <20kW/rack • Liquid cooling such as rear door heat exchanger, direct to chip cooling, and immersion cooling is required for racks with rack density >20kW/rack	
Configure DCs as hybrid model DCs to support	• The most efficient cooling solution can be catered to each rack based on rack parameters	

diverse cooling solutions for different workloads	(i.e. rack densities/chips/workloads deployed)	to raise the standards for energy efficiency in DCs
Deploy smart energy optimisation tools, including sensors and digital twins	• Dynamically control and optimise M&E systems for energy efficiency	

(b) Compute/IT equipment energy efficiency

Over the next 10 years, IMDA aims for only energy-efficient compute/IT infrastructure to be used in all DCs.

The table below summarises the Roadmap's recommendations for end-users to optimise the operation and utilisation of compute/IT equipment and how they may do so.

Recommendations	Approaches End-Users Can Take	Available Government Assistance
Use energy-efficient compute/IT equipment	• Use Energy Star certified equipment, or those compliant with the European Union's EcoDesign requirements	By end-2024, enterprise end-users can use the new Energy Efficiency Grant for the DC sector to refresh to energy efficient compute/IT equipment Introduce compute/IT equipment energy efficiency and liquid cooling standards by 2025 to facilitate adoption
Optimise power consumption when operating compute/IT equipment	• Adopt power settings that provide the appropriate balance between efficiency and performance • Enable power management features such as dynamic control of equipment power	
Optimise server utilisation	• Use virtualisation techniques to improve the utilisation of server deployments • Consolidate servers and reduce overall energy draw	
Maximise compute utilisation using green computing	• Use green software techniques such as application modernisation and computational offload	
Apply carbon-efficient software design	• Create a "demand" profile of the software by monitoring detailed utilisation data (i.e. virtual CPU, memory and disk usage)	

Recommendations	Approaches End-Users Can Take	Available Government Assistance
	• Identify "carbon hotspots" in the software "demand" profile • Minimise carbon intensity in the identified hotspots using targeted carbon reduction techniques	

Use of Green Energy

The Roadmap highlights the possibility for DC operators and energy suppliers to partner to create a demand and supply cycle for low carbon energy.

The initial recognised energy sources will comprise bioenergy, fuel cells with carbon capture, low-carbon hydrogen and ammonia, and vertical building integrated photovoltaics/building applied photovoltaics. IMDA will issue operating parameters for such low-carbon energy sources in partnership with agencies, such as the Ministry of Trade and Industry and Energy Market Authority.

Sustainable Water Usage

The Roadmap also highlights the need for DCs to have a water consumption efficiency plan and to include water efficiency management practices. Currently, DCs with annual water consumption that meets a minimum threshold of 60,000 m^3 are already required to comply with Public Utilities Board's ("**PUB**") Mandatory Water Efficiency Management Practices and submit a Water Efficiency Plan under the Public Utilities (Water Supply) Regulations.

IMDA will work with PUB to enable DCs to achieve Water Usage Effectiveness of 2.0 m^3/MWh or lower over the next 10 years. This is set out to be achieved through optimising cooling towers' water consumption – the approaches which include recycling of blowdown water (i.e. fresh water used to replace minerals-infused water in cooling towers) and increase of Cycles of Concentration through the use of electrolysis to clean cooling water, which then leads to reduced freshwater use.

Government support for water efficiency initiatives is available through PUB's existing Water Efficiency Fund, which can be used to fund water efficiency assessment, pilot study, water recycling implementation and adoption of water efficient equipment.

Concluding Words

The Roadmap is a critical step towards a sustainable digital future and sets a global benchmark for digital sustainability. IMDA's setting of energy and water targets, to be achieved over the next 10 years, highlights the necessity for DCs to start their sustainability journey now, if they have not already done

so. The Roadmap emphasises the need for a whole-of-system approach to allow for maximum innovation and effectiveness.

Importantly, IMDA's future capacity allocation exercises will require DC operators to showcase their plans to use viable low-carbon energy sources and their best-in-class solutions for lowering PUE and achieving IT energy efficiencies. These solutions may be replicated in other countries as part of the global move towards sustainable DC growth, and therefore give Singapore DC operators the opportunity to play a leadership role in this space.

The Roadmap can be accessed here.

To explore this development further, feel free to contact our team below who can guide players in the DC ecosystem on their sustainable development journey.

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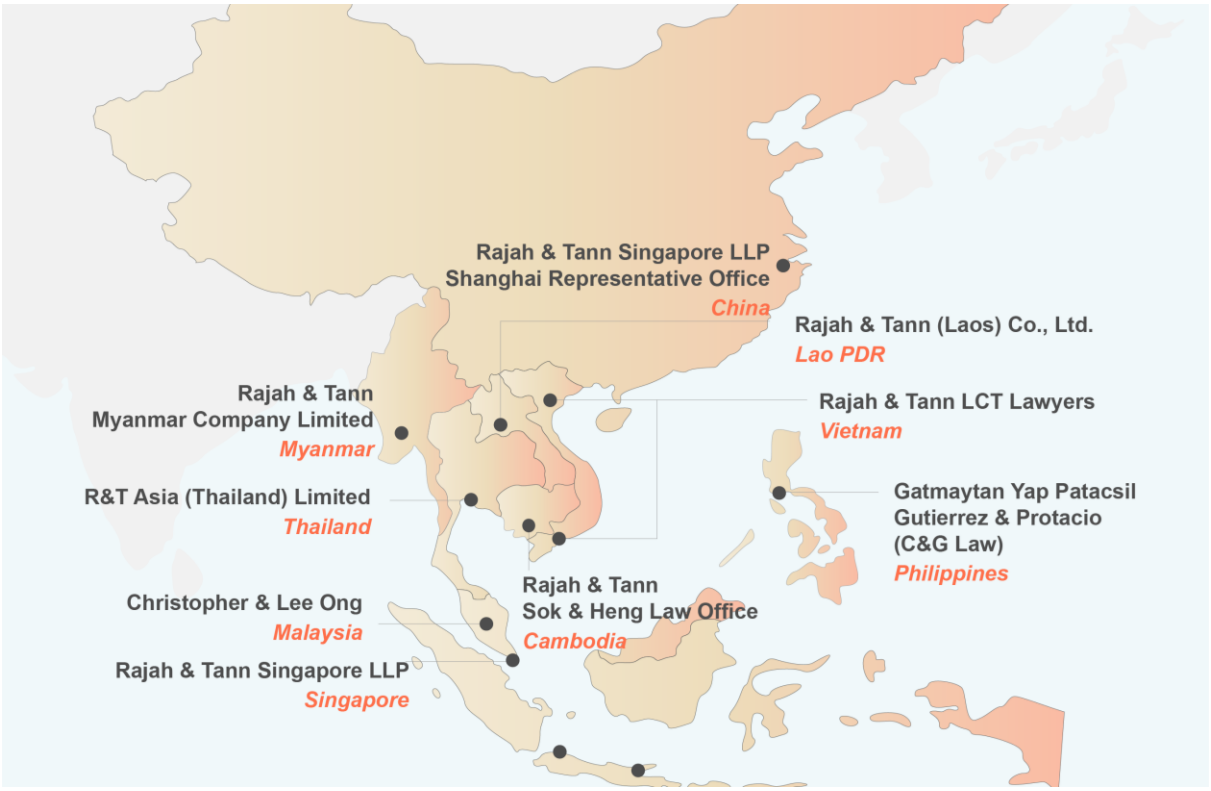

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