CUSHMAN & WAKEFIELD

THE SUSTAINABILITY IMPERATIVE FOR DATA CENTRES

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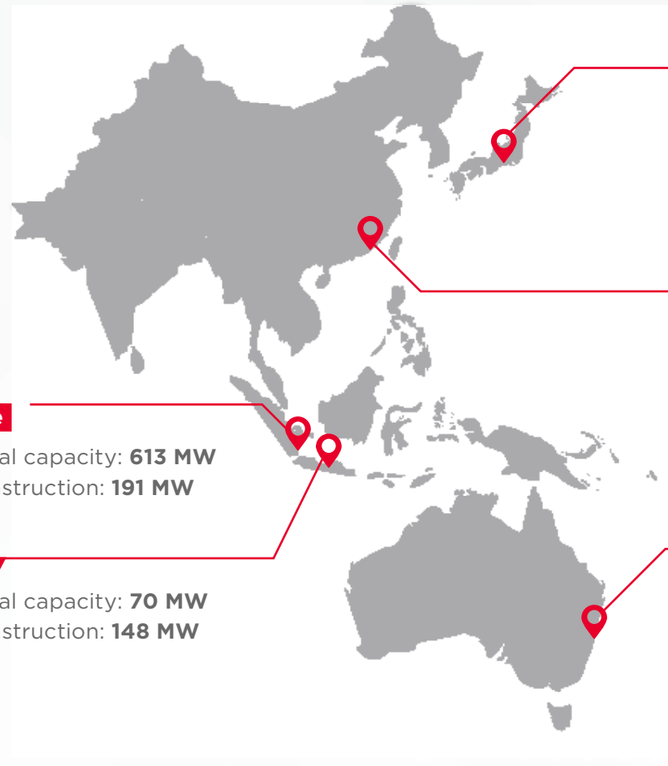
THE GREENING OF DATA CENTRES



Tokyo
Operational capacity: **801 MW**
Under construction: **130 MW**

Hong Kong
Operational capacity: **418 MW**
Under construction: **202 MW**

Singapore
Operational capacity: **613 MW**
Under construction: **191 MW**

Jakarta
Operational capacity: **70 MW**
Under construction: **148 MW**

Sydney
Operational capacity: **364 MW**
Under construction: **80 MW**

Carbon emissions from data centres across the Asia Pacific region are increasing in step with the steady uplift in new hyperscale development and sharply rising capacity.

As data centre capacity continues to grow across the Asia Pacific region, the industry is looking more intently at its carbon emissions profile. While new data centre developments are designed and built to high-efficiency specifications, older facilities are often lagging from a sustainability standpoint.

Energy usage is also rising steeply in line with surging demand. More efficient energy consumption and advances in technology are helping, however, energy is only part of the sustainability picture. When considering the entire data centre lifecycle, there is a lot more that can be done to bring down emissions.

Taking a holistic view of emissions and other imperatives for data centre sustainability were the focus of our recent webinar series. This report showcases these insights to explore current and future pathways to the greening of the rapidly emerging sector.

THE **TASK** AHEAD

> **It is a necessity to show hyperscale customers that you have green initiatives in place to accommodate their ESG goals over the long-term.**

Paul Dwyer
Senior Director, Equinix Development, xScale Asia Pacific

The pre-existing tailwinds behind data centre demand across the Asia Pacific region intensified during the pandemic. Hyperscale customers, particularly in China and the US, pushed capacity higher as the uptake of cloud computing, big data analytics, machine learning and high-performance computing solutions accelerated.

As the digital economy gained importance, data centre infrastructure expanded to keep pace. The rise of the co-location market and the 750MW of capacity currently under construction in Hong Kong, Singapore, Sydney, Tokyo, and Jakarta are testaments to outsized demand.

As more capacity comes online, the Asia Pacific region is quickly becoming the world's largest data centre market. That brings the impetus to mitigate the sector's growing carbon footprint into even sharper focus.

Alignment is the next frontier

Encouragingly, major stakeholders are already attuned to the urgent and critical need to ensure data centres are more sustainable.

Hyperscale customers now demand that data centre operators meet the sustainability criteria that supports their own ambitious ESG targets. Operators are ensuring that new data centres are designed, constructed, and maintained to high operational standards and are implementing the latest solutions to minimise emissions. Policymakers are enabling constructive regulatory reform, while academics and researchers are pushing the boundaries of technology to introduce new efficiencies.

However, across these stakeholders, a common language and a shared understanding of what needs to be done to tackle the issue of data centre sustainability remains elusive. Closer collaboration is a vital next step.

New solutions emerging

While new data centres are being engineered and constructed to minimise emissions, older facilities are less likely to be using the latest techniques. When new tenants arrive, they often seek to reduce the carbon footprint, with retrofitting and an incremental approach providing a phased pathway to greening.

Whether new or legacy facilities, the technologies that can deliver energy-efficient solutions are advancing. A range of liquid cooling technologies are gaining traction as conventional air cooling becomes unviable. The use of artificial intelligence-enabled control algorithms can monitor equipment performance and maximise energy efficiencies and operations.

In addition, innovative energy procurement strategies can help ensure renewable supply without compromising reliable power. The prospect of cooling-as-a-service presents further efficiencies, where cooling can be outsourced to a provider with the latest energy-efficient technology avoiding the capital expenditure required to upgrade.

Moving beyond energy

As rack power density rises, energy efficiency will be a crucial determinant of future emissions. However, looking at that in isolation ignores the multi-faceted nature of a data centre's emissions footprint. Thinking about the lifecycle of the building and its operational uses reveals a more holistic picture of carbon intensity.

Addressing this requires an equally holistic approach to sustainability, from reducing the embodied carbon within the building process, how the design allows for efficiencies and future flexibility, and the need for more sustainable supply chains, to name a few considerations. And sustainability also extends to other natural resources, particularly land and water.

> **You need to be open to sharing best practice, so the whole industry can steer together towards the green data centre vision.**

Joshua Au
APAC Chapter Leader, Infrastructure Masons

ADVANCING THE **GREEN AGENDA**

There are multiple organisations and initiatives at the forefront of the sustainable data centre movement. Recently, the global, non-profit, professional association for digital infrastructure, Infrastructure Masons (iMasons), launched its Data Centre Sustainability Framework to standardise a measure and definition of a 'sustainable data centre'.

IMasons' 'Every Click Improves the Future' campaign sought to shift the data centre sector's current fragmented approach to a unified model. It argues that the current focus on multiple frameworks – from power and water usage effectiveness to the hundreds of available sustainability certifications – is slowing progress.

Instead, iMasons created an ***Industry Best Practice and Sustainability Framework*** that covers all phases of the life of a data centre, from planning to designing, building, operating, and decommissioning. It has developed a simple rating system to illustrate a data centre's sustainability.

Academics and the private sector are also coming together to pursue solutions. In collaboration with Singapore's data centre industry, The National University of Singapore (NUS) and NTU Singapore launched the Sustainable Tropical Data Centre Testbed (STDCT). The STDCT is a first-of-its-kind innovation hub and research programme established to develop new sustainable cooling solutions for data centres in the tropics.

The NUS, in conjunction with Surbana Jurong, Singapore LNG Corporation (SLNG) and the National Supercomputing Centre (NSCC) Singapore, is also commencing a feasibility study for a green modular data centre. A primary objective is to better understand the efficiency gains of using seawater for heat sinking with the potential to reduce energy usage by up to 0.2 megawatts. This energy saving would deliver a significant improvement on the typical load profile of smaller development projects.

Operators are also looking further afield for non-technical solutions. Equinix, for example, has completed its third green bond issuance raising billions of dollars that will help fund green initiatives. The organisation has established a Green Finance Framework to standardise its green debt disclosures.

iMasons 'Every Click Improves the Future' goals

1. Unify the industry on a sustainability vision and outline specific actions
2. Make renewable energy available everywhere
3. Define a sustainable data centre framework
4. Drive sustainability through procurement
5. Achieve radical efficiency through innovation

OPTIMISING LEGACY DATA CENTRES

While new data centres are designed to be highly efficient, particularly best-in-breed hyperscale facilities, legacy facilities can present significant challenges for sustainability-conscious operators and investors. With the number of older sites dwarfing the number of new hyperscale and co-location data centres, modernising this market segment remains crucial to making tangible progress towards overall carbon reduction.

There are multiple solutions to elevating the sustainability credentials for legacy facilities. Moving equipment into hosted locations or migrating to the cloud is an option. Another is taking an incremental approach to upgrading operations, including:

- More basic measures to increase cooling efficiency, including using a raised floor.
- Taking a phased approach to moving from conventional air cooling to liquid cooling systems.
- Review the hardware specifications, power density and cooling capacity to determine the potential to upgrade to more efficient equipment.

The other options for those with capital expenditure flexibility is to start again by planning, designing, and building a new efficient data centre on the existing site. Even before selecting the site, detailed extensive due diligence is required.

The Due Diligence Checklist

1. **Site planning** – understanding contaminants for greenfield sites or disposing of brownfield structures.
2. **Surveying the grid** – identifying energy mix based on location and ability to secure renewables supply.
3. **Consult planning authorities** – determine the potential for on-site renewables generation or use of fuel cells.
4. **Progress into design** – explore building standards that govern best-practice sustainability, such as LEED or NABERS.
5. **Future-proofing** – understanding the business needs, ease of operations and building flexibility into the design to accommodate new technologies in sustainability measures.

TEMPERATURE VS **PERFORMANCE**

Operating hardware at higher temperatures can save significant amounts of energy and reduce the emissions associated with keeping ambient temperatures lower. But the question remains as to what temperatures strike an optimal balance between energy efficiency and hardware performance. And going one step further, asking how high temperatures can go before it affects system shelf life and serviceability.

However, raising the temperature can move beyond hardware reliability, with testing showing that technology performance can be affected when operating at higher temperatures. In these circumstances, where chip usage may be approaching the upper limits of safe operating temperatures, server usage can go up. This can lead to higher IT-related power consumption.

The chip manufacturers are aware and are taking steps to improve efficiency. Intel, for example, is partners in the Open Computing Project Foundation and have been part of decade long discussions about improving the efficiency of servers as well as networks.

Over time, the data centre industry has become more comfortable raising the ambient temperature within rooms, particularly considering sustainability imperatives. There is an acknowledgement that only a few degrees can make a vast difference to energy usage.

The methods used to find the right temperature balance include warm water cooling and seawater cooling for prospective undersea centres that ensure low wastage. In addition, a range of engineering solutions are being developed to remove redundancies and achieve electrical efficiencies.

> **Increasing supply temperatures can lead to a reduction of energy for cooling but increased server power consumption, so efficiency needs to be a holistic assessment.**

Poh Seng Lee
Executive Director,
Energy Studies Institute
N.U.S.

NEXT GENERATION SOLUTIONS

COOLING-AS-A-SERVICE

Given the contribution of cooling systems to carbon emissions, finding new and efficient cooling methods is crucial. One option being discussed is using a cooling-as-a-service model, where operators outsource their cooling requirements to external experts, purchasing their outputs on a per-kilowatt basis as required.

There are at least two significant advantages to the cooling-as-a-service model. The first is that experts in energy-efficient cooling manage that function and the associated carbon emissions so operators can focus on their core business.

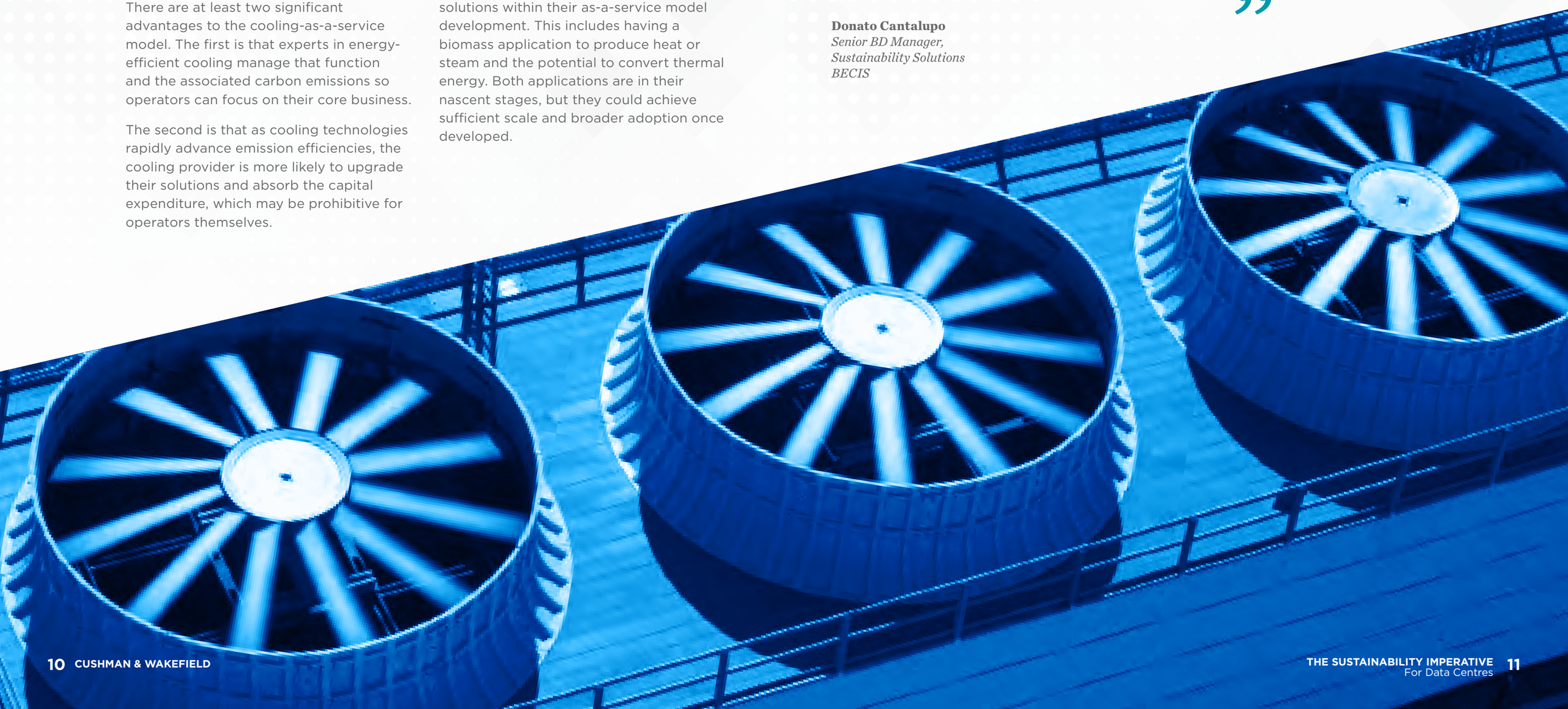
The second is that as cooling technologies rapidly advance emission efficiencies, the cooling provider is more likely to upgrade their solutions and absorb the capital expenditure, which may be prohibitive for operators themselves.

While this model has been broadly applied in the solar energy industry, it is a relatively new concept for cooling data centres. Currently, there is one commercial building trialling the model in Singapore.

In pursuit of more energy-efficient cooling, outsourced providers are considering the next step in utilising renewable energy solutions within their as-a-service model development. This includes having a biomass application to produce heat or steam and the potential to convert thermal energy. Both applications are in their nascent stages, but they could achieve sufficient scale and broader adoption once developed.

> **“Operators are focused on their main activities and may not have the time or knowledge to properly run a cooling facility. Outsourcing this means an external company will optimise the day-to-day running and drive sustainability.”**

Donato Cantalupo
Senior BD Manager,
Sustainability Solutions
BECIS



LIQUID COOLING TECHNOLOGIES

Liquid cooling methods have been a feature of data centres for decades, with their origins in more effective cooling for mainframes and supercomputers. Today, as rack power density increases to meet the demand for greater processing capacity, liquid cooling is more commonplace.

Liquid cooling has also gained further traction over less efficient air-cooling methods. However, for power under 25kW per rack, air cooling remains a viable solution.

There are many new advancements in liquid cooling methods and systems as the research and testing in the area expands. One example is the emergence of direct-to-plate cooling, a closed-loop heat transfer mechanism. A customised cold-plate is applied directly to the rack, with connected tubes circulating cool water to replace warm water.

Another is immersion cooling, a more advanced technology that is attracting substantial attention, particularly for equipment powering more sophisticated technology applications. Using this method, servers are fully immersed in a dielectric fluid that efficiently facilitates the transfer of heat from the submerged devices.

Generally, it is important to maintain a constant flow of cool liquid to the hardware, which means having a reliable distribution system. A failure or even a temporary stoppage can be detrimental to the servers, which is where having cooling systems controlled with predictive capabilities can assist.

ADVANTAGES

compared to air cooling, liquid cooling uses less energy and water, less space and produces less noise.

DISADVANTAGES

liquid cooling can be more costly and requires operators to develop new capabilities or even adopt a new management framework.

> “We are hearing more and more about liquid cooling for data centres primarily because servers are demanding high powered GPUs and CPUs to meet processing demands.”
>
> **Janet Low**
> *Regional Sales Manager, Systems*
> *Armstrong Fluid Technology*

DEEP LEARNING INFRASTRUCTURE

Artificial intelligence (AI) and deep learning capabilities can enhance operational efficiency and data centre performance. Many data centres operate multiple systems from lighting, cooling, and the servers themselves, and AI-enabled solutions can ensure that these systems work harmoniously together.

GPU cluster solutions using AI can act as a master control and identify deviations from normal operations. They can provide feedback on the optimal settings for energy-intensive systems and help distribute the load more evenly depending on usage and desired settings.

Essentially, these technologies can introduce far more accurate tracking, controlling, and planning for energy consumption, impacting IT performance and emissions.

The major hyperscale facilities are already using AI to closely monitor cooling systems and optimise energy usage, particularly those where rack power density is pushed beyond 30kW.

There is also a need to build AI infrastructure that is efficient yet scalable from a single system to multiple racks. With a heightened focus on cooling technologies that utilise renewables supply and are applied direct-to-chip, AI has a more prominent role to play in optimising these integrated systems.

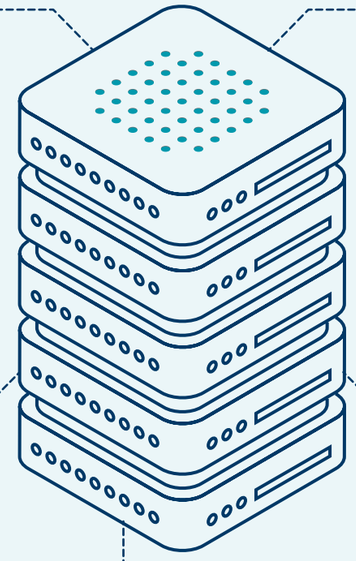
> **There is a lot of focus on making data centres more efficient by combining new cooling technologies. AI can help make them scalable and maximise utilisation.**

Alee Fong
Director, Business Development
Lambda

SUSTAINABILITY ACROSS THE **DATA CENTRE LIFECYCLE**

As the Asia Pacific data centre market continues to grow, the sustainability imperative becomes stronger. What's clear is that the approach to containing emissions while increasing capacity relies on decarbonising every aspect of the supply chain, operations, and facility management. Without a more holistic approach across the entire lifecycle, the sustainability in the Asia Pacific data centre market will be only partially addressed.

DATACENTRE LIFECYCLE



PLANNING AND BUILDING

- Embodied carbon reduction within construction process
- Decarbonise supply chain
- Sustainable waste disposal and decommissioning at end-of-life

FUTURE-PROOF DESIGN AND CONFIGURATION

- Understanding optimal temperatures
- Accommodating future technology advances
- Selecting the right sized rooms
- Reinforced floor plates

ENERGY

- Renewables procurement
- On-site renewables generation (replacing diesel gen back up)
- Driving PUE towards 1:1
- Cooling-as-a-service

CONSUMERS

- Awareness of behavioural changes required to influence demand on Data Centre capacity

OPERATION

- Liquid cooling technologies
- AI controls
- Supply temperatures
- Waste minimisation
- Efficient water use

OPERATION

- Periodic reviews of equipment/upgrades for efficiencies
- Understanding the impact of ambient temperature on IT performance
- Reduce idle state power consumption

REPORTING

- Transparency in reporting scope 1-3 emissions

WEBINAR SERIES |

THE SUSTAINABILITY IMPERATIVE FOR DATA CENTRES ACROSS ASIA PACIFIC

Click on title to watch the replays

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About Cushman & Wakefield

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