Powering possibility: Closing the clean energy gap for Asia Pacific data centres

July 2025

Content

Executive summary

Driven by soaring demand for AI, cloud and advanced digital services, data centres across Asia Pacific are expanding rapidly – and so is their need for power.

Electricity consumption is expected to climb from 320 terawatt-hours in 2024 to 780 terawatt-hours by 2030. Yet only 32% of that demand will be met by renewable energy. The gap is significant – and closing it is critical.

This is more than an energy challenge. It's a connectivity challenge. Grid infrastructure needs to evolve, expanding and adapting to manage fluctuating demand and diverse energy sources.

Governments are raising the bar. Ambitious carbon neutrality targets are reshaping policies, incentives and regulations, influencing where and how data centres are designed, built and powered.

Meeting these challenges will take more than incremental change. Operators need to accelerate adoption of alternative energy – from hydrogen and ammonia to nuclear – backed by large-scale storage solutions. More efficient power and water usage, combined with innovative cooling, will also be essential.

Financing the shift will take a mix of strategies. Alongside equity and project finance, leaders need to explore options like corporate funding, private credit, mezzanine financing and bonds. Recycling capital through the sale of stabilised assets can also free up funds for new development and draw in yield-focused investors.

The message is clear. Solving this will take bold, collective action. Collaboration across energy, infrastructure, policy and finance is the only way to embed sustainable, reliable power into the digital backbone of the region. Realising the full potential of AI and cloud technologies depends on it – and with the right action, Asia Pacific's data centres can set the global standard for what's possible: resilient, future-ready and sustainable. Now is the time to act.

01

Data centre market in Asia Pacific

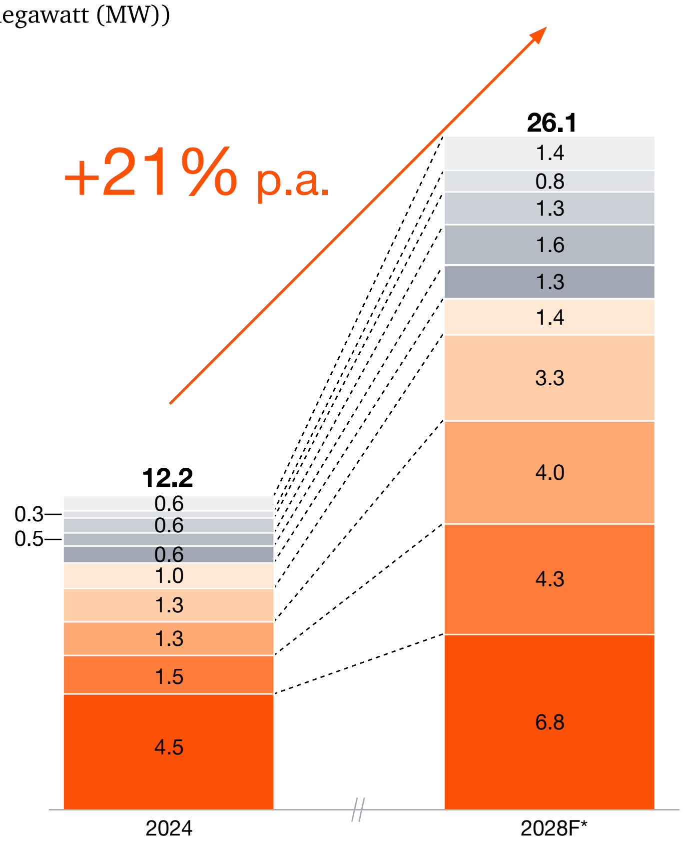
The data centre market

Asia Pacific captures around 30% of global data centre[1] capacity and is expected to grow at a compound annual growth rate (CAGR) of 21% from 2024 to 2028. This momentum is being fuelled by surging demand for cloud-based services across industries, the rollout of 5G networks and the accelerating adoption of artificial intelligence.

The region hosts more than 1,800 data centres[2], with 12.2 GW of live capacity as of the end of 2024 – expected to more than double to 26.1 GW by 2028. The region witnessed the largest data centre-related acquisitions in recent years including Blackstone's US$16 billion[3] acquisition of AirTrunk, underscoring strong investor confidence in the region's growth prospects. These transactions, and others, have recorded transaction multiples exceeding 20 times the target's forward core earnings in the last five years.

Fig. 1 2024-2028 APAC data centre projected growth in capacity ('000 megawatt (MW))

	Capacity Growth (GW)	CAGR 24-28F*
Rest of Asia Pacific	0.8	23%
Indonesia	0.6	31%
Hong Kong (SAR)	0.7	22%
Malaysia	1.0	32%
South Korea	0.6	19%
Singapore	0.4	8%
Australia	2.0	27%
India	2.7	32%
Japan	2.8	30%
Chinese Mainland	2.3	11%



* F = Forecast

Source: PwC Analysis, Cushman & Wakefield / Notes: 1) Rounded values; 2) South Korea capacity based on H1 2024 value; 3) Asia Pacific territories in this analysis include Australia, Chinese Mainland, Hong Kong (SAR), India, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore, South Korea, Taiwan, Thailand & Vietnam only.

"The convergence of hyperscalers, infrastructure providers, energy and telecommunication network operators is fuelling the rapid expansion of data centres globally, not to mention the rapid adoption of artificial intelligence."

Wilson Chow
Global Technology, Media and Telecommunications ("TMT") Industry Leader and China AI Leader at PwC

Asia Pacific's data centre market is poised for growth

Compared to more developed markets, Asia Pacific's data centres are expected to grow at a faster pace. Strong demand is set to continue, with major capacity expansions underway in key hubs such as Tokyo (Japan), Mumbai (India), Melbourne (Australia) and Johor (Malaysia) – collectively accounting for over 5 GW[1] in planned or in-progress capacity. Rising adoption in key digital technologies – cloud, 5G and AI – will boost demand and there will likely be government policies looking to strengthen the sector.

AI Diffusion Act – Policy uncertainty makes planning difficult

In January 2025, the US introduced the AI Diffusion Act, establishing a three-tier framework that categorised countries' access to advanced AI hardware and software. The legislation imposed limits on the AI computing power that US companies and hyperscalers could deploy outside Tier 1 territories.

Although the Act was rescinded in May 2025, it was followed by new announcements aimed at tightening export controls on semiconductors worldwide. This period of policy volatility has added complexity, making long-term planning more difficult – particularly given the risk of future restrictions on chip access and heightened sensitivity around geographic concentration.

India, Malaysia, Indonesia, Japan and Australia leading the next wave of growth

The top seven territories by data centre capacity – Chinese Mainland, Japan, India, Australia, Singapore, South Korea and Hong Kong SAR– account for 90%[1] of the total installed capacity in region. Individual markets display diverse growth drivers and market conditions. India, Malaysia, Indonesia, Japan and Australia emerge as top growth markets with highest projected CAGR to 2028[1]. By contrast, China and Singapore have lower expected CAGR due to their high market maturity and the shifting of workloads to nearby territories.

Case study:

Japan

Growing investment of AI in Japan

Japan is actively advancing its AI capabilities across various sectors, positioning itself as a leader in AI innovation and adoption, supported by the Japanese government's push in AI-driven industries such as manufacturing, finance, automotive, gaming and healthcare. The country's attractiveness as an AI hub and growing data centre market, as evidenced by rising data centre occupancy rates and rental yields – has seen significant investments from large global players and local Japanese conglomerates. For example, Microsoft committed US$ 2.9 billion[4] to the development of AI data centres in Japan by 2025, marking its largest investment in the country to date, whilst SoftBank[5] plans to transform a manufacturing plant in Osaka into a large-scale data centre focused on AI operations.

These moves are expected to proliferate the growth of data centre industry in Japan. The Ministry of Economy, Trade and Industry identified AI infrastructure as a core driver of digital transformation. We expect more public-private partnerships to support the growth of Graphic Processing Units (GPU) capacities and sustainable computing practices in the years to come. Japan's green transformation (GX) and digital transformation (DX) initiatives aim to create a sustainable, resilient and technologically advanced society. GX focuses on achieving carbon neutrality by 2050, emphasizing renewable energy adoption, energy efficiency, and sustainable industrial practices. Concurrently, Japan's DX strategy aims to modernize its economy through the integration of digital technologies across various sectors.

Shift towards decentralisation of data centres

Currently, more than 50% of Japan's data centre capacity and 98%[6] of internet exchange access are concentrated in Tokyo and Osaka. This heavy reliance on two urban hubs presents notable risks – particularly in the event of localised natural disasters – and underscores the need for strategic decentralisation.

To address this, the Japanese government[7] is encouraging the redistribution of data centre infrastructure to rural regions such as Hokkaido and Nagano. These efforts aim to improve national resilience while tapping into renewable energy sources available in those areas, such as wind power.

In addition, occupancy rates in Greater Tokyo and Greater Osaka currently stand at 80–90% and are projected to exceed 90% by 2028, signalling future capacity constraints. By expanding data centre development into less densely populated areas, Japan not only reduces pressure on urban centres but also stimulates regional economic growth and supports broader technological integration across the country.

Fig. 2 Data centre occupancy rate in Japan, by key regions (%)

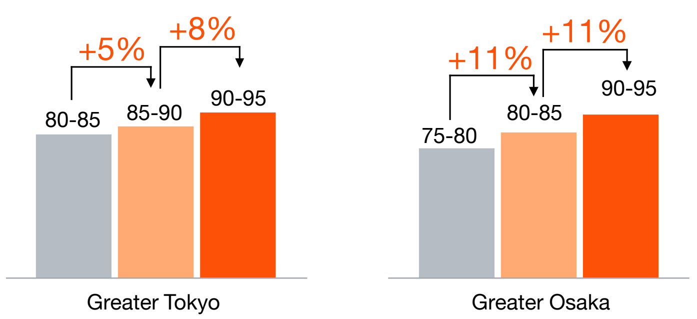
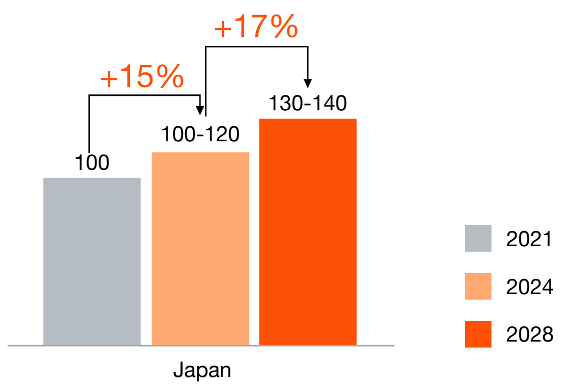


Fig. 3 Data centre colocation rent in Japan, (Rent Index, 2022=100)



Source: PwC Analysis, Jones Lang LaSalle

Case study:

India

Surging internet consumption fuels demand for data centre capacity

According to the Telecom Regulatory Authority[8] of India, the average monthly internet data consumption per subscriber surged from 0.3GB in 2014 to 20GB in 2024, reflecting an annual growth rate of more than 50% over the past decade. Yet, despite this surge, the Internet & Mobile Association of India reports that the percentage of internet users remains relatively low at 63% in 2024. This figure is projected to reach 80-90% of India's population by 2028.

This explosive projected growth is driving an increasingly localised need for data centre capacity – to store, process and manage the rising volumes of data within India.

The challenge: Power infrastructure and water scarcity

India's data centre expansion depends heavily on reliable access to power and water – both of which are under strain in an already resource-constrained ecosystem. While demand for data services continues to grow, the supporting infrastructure is struggling to keep pace.

Water availability in particular is becoming a flashpoint. Several urban and suburban centres – including Mumbai, Bengaluru, Delhi and Chennai – are experiencing signs of water stress[9]. As data centres draw heavily from municipal water supplies for cooling, their growth is contributing to local shortages.

This may force data centres to relocate to other cities and potentially disrupt the digital ecosystem in these key cities. It has prompted some operators, such as Google and Microsoft, to shift to recycled wastewater for cooling – a move aimed at easing pressure on freshwater supplies. Coastal regions may offer a viable alternative, with cooler climates and near-shore wind energy helping to reduce both water and power demand for cooling-intensive operations.

Key themes in data centre market

AI and cloud adoption driving data centre growth

Asia Pacific's AI-related data centre capacity is expected to grow at a CAGR of 21% from 2.2 GW in 2024 to 4.8 GW in 2028. This growth is being further fuelled by the rapid expansion of the region's public cloud services market, as organisations continue to migrate workloads to the cloud at scale.

The intensive computational requirements of AI applications – particularly for AI training and inferencing – are significantly increasing demand for high-performance infrastructure.

AI landscape and trends

Rising AI adoption and LLM development are driving higher computing and energy needs

Large hyperscale cloud providers and corporations across various industries are increasingly building large language models (LLMs) capable of natural language processing and understanding. Building and training these models requires intensive computing power, which is expected to lead to a significant increase in electricity demand.

Small language models are gaining traction with the like of Deepseek demonstrating the efficiency and speed associated with using fewer parameters and having smaller size. Demand is expected to grow as it is valuable for practical, cost-effective deployment across various language tasks.

Emergence of low-latency computing could affect location of data centres

AI applications requiring low latency (real-time data processing) – such as autonomous driving, industrial sensors, or Augmented Reality/Virtual Reality (AR/VR) gaming – are creating new demands on infrastructure. However, the pace of adoption varies widely across geographies.

Advanced AI markets such as Chinese Mainland, Singapore and Japan are more likely to see growth in low-latency computing infrastructure. In contrast, neighbouring territories may serve as locations for higher-latency workloads in the data centre space, creating demand for digital infrastructure build out across the region.

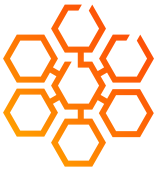
New high-capacity AI data centres may outpace retrofits

Substantial capital is being invested in the construction of new, high-capacity data centres designed specifically for AI workloads. Retrofitting existing facilities is often impractical, as older centres may lack the power, cooling and load-bearing capacity to support high-density GPU infrastructure.

AI impact on location, design and power specifications

The emergence of AI has created a conundrum for location, design and operational requirements. It generally falls into two categories: training and inference.

AI training
involves teaching a model to identify patterns or perform tasks by processing vast datasets. It is highly compute-intensive and demands significant power and infrastructure scale.



AI inferencing
uses a trained model to make predictions or generate outputs based on new data. It is less compute-intensive but often requires much lower latency to support real-time applications.

Proximity to data sources, improved connectivity and access to energy

With an increase in AI applications which require low-latency data processing, it would be more beneficial for data centres to be located closer to data sources. Proximity reduces response times and improves the performance of AI-powered services. However, in dense urban areas, land availability remains a key constraint.

For AI training workloads, latency is less of a concern. In these cases, scale and power access become the primary considerations. Land-scarce territories or cities such as Singapore or Tokyo have started to take innovative approaches in pursuit of futureproofing future growth.

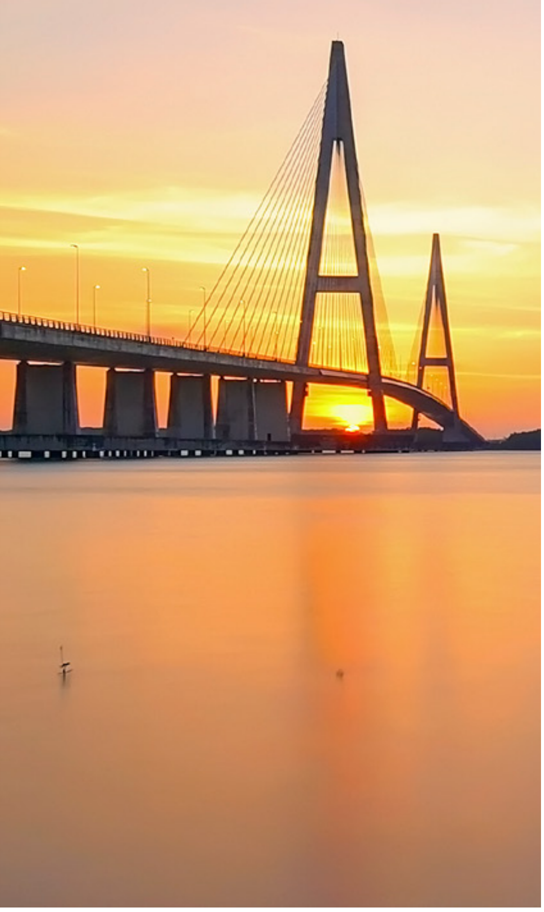
The following case study illustrates how Singapore is focusing on low-latency AI inferencing within its borders, while performing high-latency workloads in neighboring regions. Singapore's strong network of connectivity provides a robust infrastructure to tap on upcoming capacities from Johor (Malaysia) and Batam (Indonesia). This allows corporations to conduct high-latency AI training with scale in these neighboring regions while situating critical, last-mile, low-latency AI inference workloads in Singapore.

Access to energy continues to pose a growing concern for many territories. The energy demands of AI workloads are pushing data centre operators to seek locations with stable, high-capacity electricity supply and low risk of disruption. Energy costs and sustainability targets are also front of mind – prompting operators to favour areas with affordable electricity and access to renewable sources. However, a more fundamental issue is access to the energy grid itself. Even in energy-constrained territories, the development of a robust and flexible grid will be critical. Grid readiness will determine whether operators can reliably tap on imported energy easily.

Case study:

Johor – Singapore

Special Economic Zone

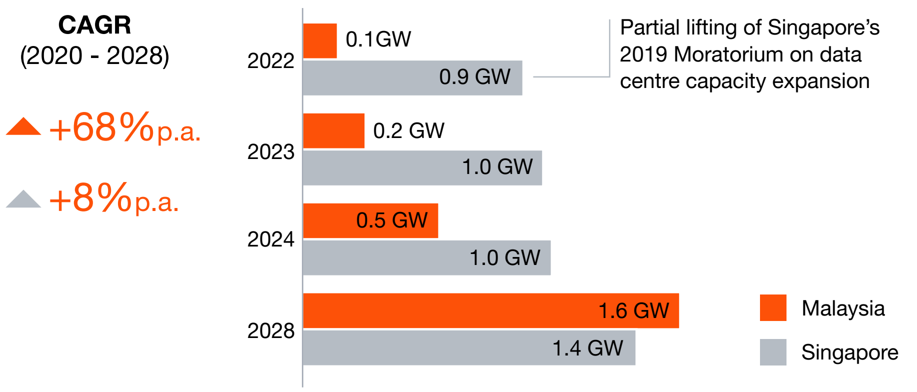


A focus on low latency in Singapore, high latency training workloads in Johor, Malaysia

The Johor-Singapore Special Economic Zone (JS-SEZ) is emerging as a key development to watch in Asia Pacific's data centre landscape. Anchored by the 745-acre Sedenak Tech Park (STeP)[10] and the 509-acre Nusajaya Tech Park, the SEZ offers tax incentives and access to upgraded infrastructure for companies establishing data centres in the region.

Johor presents a compelling value proposition – with more affordable land, lower construction costs and reduced operating expenses, including competitive electricity tariffs.

Fig. 4 Projected growth in data centre capacity in Malaysia and Singapore ('000 MW)



Source: PwC Analysis, Cushman & Wakefield / Notes: 1) Assuming a full realisation of 2024 planned and under construction DC capacity by 2028; 2) Addition in live capacity for Malaysia based on Johor alone

By contrast, Singapore faces a constraint on land availability and has taken steps to manage growth sustainably. A moratorium on new data centre builds was implemented in 2019 and partially lifted in 2022. In 2023, Singapore introduced a Call for Application (DC-CFA), allocating 80 MW of new capacity across four new data centre projects[11].

This sets the stage for a dual-location strategy:

- Low-latency AI inference workloads can be hosted in Singapore, where robust digital infrastructure supports real-time responsiveness and minimises downtime.
- High-latency training workloads can be located in Johor, where energy and space constraints are less severe.

This setup is enabled by strong subsea cable connectivity linking both markets to global hubs. The SEZ has the potential to serve as a model for regional data centre integration – enabling workload specialisation and shared benefits across neighbouring territories.

Rising power densities are driving innovation in cooling and infrastructure design

AI workloads are compute-intensive, requiring specialised hardware such as GPUs, Tensor Processing Units (TPUs) and other AI accelerators designed to handle parallel processing and complex calculations efficiently. As these workloads scale, they are significantly increasing power densities in data centres – pushing the limits of traditional cooling and infrastructure design.

The average power density of AI server racks has doubled to an average of 15-20 kW in the last few years and is expected to rise further to 40-50 kW by the end of 2027. Some AI data centres are exploring rack densities of 100kW or higher. This shift is also accompanied by a broader move from more general-purpose data centre semiconductors to specialised chips, which can deliver efficiency gains. However, the overall net impact of such power efficiency gains at a chip level remains somewhat unclear as the increase in power density on new individual chips will mean that cooling needs still increase with time.

Cooling innovation is becoming critical. Advanced cooling technologies such as liquid cooling and environmentally friendly systems are being deployed to minimise energy consumption while maintaining optimal operating temperatures.

These new cooling methods have the potential to reduce total data centre energy consumption by as much as 5–15%[12].

In addition to cooling technologies, racks and server designs are evolving to improve thermal management. New materials and components are being used to enhance airflow, dissipate heat more effectively and reduce obstruction within server environments – enabling more targeted and efficient cooling.

Despite these advancements, there is currently no industry-wide standard for next-generation cooling. Most data centre operators and technology providers are developing proprietary systems, which leads to higher integration costs and slows widespread adoption. Establishing shared standards could help accelerate uptake, reduce costs and unlock broader efficiencies across the sector.

Sustainability initiatives

Pressing need for sustainable energy generation to keep pace with data centre electricity demand

Power and energy play a crucial role due to the high energy demands of data centre operations. According to the International Energy Agency, data centres already account for around 1–2%[13] of global electricity consumption. By 2030, this share is expected to double.

This trajectory presents significant challenges: how do we meet surging energy demand, especially if the energy is to be green, and whether power grids can handle the demand and energy mix.

In Malaysia, for example, Tenaga Nasional Berhad (TNB) projects that data centre electricity demand will reach 5,000 MW beyond 2035. TNB has already received 11,000 MW worth of data centre energy supply applications – equivalent to nearly 40% of Malaysia's current total power generation capacity. This signals the immense appetite for energy – and the urgent need to scale up renewable energy sources.

Putting energy consumption into perspective, a 100 MW[14] capacity data centre may consume energy equivalent to…

40

Shopping centres[14]
(assuming >50,000sqm each)

360

Warehouses[14]
(assuming > 20,000sqm each)

440

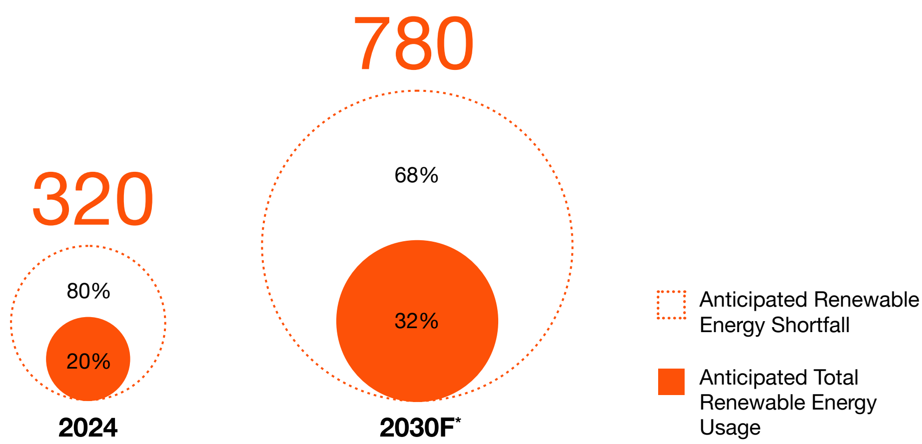
Office buildings[14]
(assuming ≈10,000sqm each)

Traditionally, these facilities have leaned heavily on fossil fuels, prompting sustainability concern.

The renewable gap: demand outpacing supply

Renewable energy by itself is unlikely to be sufficient to power the energy consumption demands of data centres. The electricity consumption of the top six Asia Pacific territories by data centre capacity (Chinese Mainland, Japan, Australia, India, Singapore and Korea) is expected to grow by 16% annually until 2030, reaching nearly 750-800 TWh. While there are significant renewable energy generation investments in Asia Pacific, the generation is expected to increase at a slightly lower pace of 13% annually. This implies that the current renewable energy gap of 200-300 TWh may widen to over 500 TWh according to PwC analysis below.

Fig. 5 Estimated Total Electricity Consumption of Data Centres in Asia Pacific (In terawatt-hours (TWh))



* F = Forecast

Source: PwC Analysis / Notes: Based on top 6 territories in Asia Pacific by DC capacity. Top 6 territories make up 84% of Asia Pacific DC capacity in 2024.

So, while renewable energy remains central to powering data centres more sustainably, it's unlikely to be enough to meet the region's fast-growing energy demands alone. To close the widening gap, data centre operators are exploring alternative energy sources – including hydrogen, ammonia and nuclear power – while also investing in efficiency improvements and carbon offset strategies.

"Amidst the rapid evolution of AI workloads, the industry stands at a crossroads where the integration of cutting-edge cooling technologies and alternative energy sources like hydrogen and ammonia is not just an option, but a necessity to bridge the sustainability gap and meet the escalating power demands."

Jennifer Tay
Asia Pacific Infrastructure Leader
PwC Singapore

Pathways to sustainability

Key trends	Observations
Improving data centre design to improve efficiencies	Data centre operators are retrofitting existing facilities to improve operational efficiency and keep up with sustainability efforts. Focuses on developing innovative solutions such as liquid cooling etc. to enhance energy and water efficiency, with new facilities targeting Power Usage Effectiveness (PUE) values < 1.2. Photonics data centres use light-based data transmission which generates less heat and reduces cooling requirement.
Increasing use of renewable/ green energy	Signing power purchase agreements (PPAs) for future renewable energy demand needs. Meanwhile, larger data centre operators may build on-site renewable energy generation technologies too. Sources such as ammonia, nuclear and hydrogen can be considered too. Using energy storage systems such as Battery Energy Storage Systems (BESS) to store excess energy generated and release it for usage during peak demand.
Investing to offset carbon footprint	Industry players are purchasing carbon credits, renewable energy certificates (RECs) or energy attribute certificates etc., to offset carbon emissions.

Navigating renewable energy maturity and alternative energy pathways

While territories such as Chinese Mainland and Japan lead the region in renewable energy adoption, Southeast Asia (SEA) still lags. The shift from fossil fuel dependency to renewables in SEA will require substantial investment in infrastructure. However, government hesitation to increase public debt for infrastructure development often limits the speed of transition.

Private investors must carefully navigate regulatory policies, political dynamics and licensing requirements when investing in or establishing renewable energy facilities. Players must adopt a localised perspective when evaluating the feasibility of renewable energy investments in different territories.

Power Purchase Agreements as a pathway to renewable energy adoption

One of the many ways major data centre operators commit to sustainable energy is via the use of Power Purchase Agreements. PPAs are long-term contracts between an electricity generator and a customer, for the sale of electricity at predetermined pricing. By entering PPAs, data centres can meet their targeted renewable energy and carbon neutrality goals while scaling sustainably.

Grid and scale limitations need to be considered when using PPA, with some territories better positioned than others:

1. Physical and virtual PPAs require electricity to be transmitted through national grids, which can become increasingly strained as new data centres come online.
2. Under direct/private wire PPAs, a direct sale of electricity from generator to data centre operator happens, bypassing national power grid. One limitation is the necessity for data centres to be near the renewable energy source. This proximity is crucial for establishing direct electricity lines, which often requires substantial investment in substations and infrastructure development.
3. Data centre sustainability depends on grid readiness, so scaling renewable energy access must happen in parallel with energy infrastructure development. Without this, renewable energy adoption may fall behind demand.

Leveraging energy storage solutions

Given the intermittent nature of renewables like solar and wind, on-site energy storage is increasingly essential to support 24/7 data centre operations. One emerging solution is the Battery Energy Storage System (BESS), which stores surplus energy and discharges it during periods of low production or peak demand. BESS could also act as a backup power source, reducing the need for fossil alternatives such as diesel generators.

Some alternative clean energy sources remain early-stage

While alternative energy sources offer promise, few are currently commercially viable at scale:

- Green hydrogen may be a sustainable energy source when produced via electrolysis. However, producing green hydrogen could be energy intensive and large-scale production requires high investment and capital costs. Hydrogen remains significantly more expensive than natural gas due to capital expenditure, long distance transportation cost and the conversion between different mediums. Hydrogen production sites that are close to the end users remain the more viable business cases.
- Ammonia has potential as a green hydrogen storage medium (in which synthesised ammonia can be combusted back into hydrogen) with lower emissions than fossil fuel-based electricity, but production at scale is in its infancy.
- Nuclear energy is clean, but long lead times make it a slow solution. Traditional plants may take up to 20 years to become operational and require significant government funding and planning.
- Some territories are exploring Small Modular Reactors (SMRs) – compact, prefabricated nuclear units with passive safety features. SEA countries such as Indonesia, the Philippines and Thailand have begun nuclear feasibility studies[15], though commercial viability is still several years away as SMRs remain in the research and development phase.

Carbon offsets such as RECs are a stop-gap – not a permanent solution

In the short term, many data centre operators have been relying on carbon offsets to meet sustainability goals. These include:

- Purchasing carbon credits
- Investing in out-of-market renewable projects
- Acquiring Renewable Energy Certificates or Energy Attribute Certificates

While effective as an interim measure, this approach is drawing increasing scrutiny. Operators are under growing pressure to contribute directly to emissions reduction – not just offset them. Moreover, RECs must be retired upon redemption, meaning they cannot be resold or reused. While they may serve as a quick solution, they cannot be a permanent solution if data centres are to truly decarbonise.

Regulatory policies and incentives

Governments act

With the increasing urgency of climate change and its adverse impacts on ecosystems and economies, governments across Asia Pacific are setting clear deadlines for achieving carbon neutrality. These commitments are beginning to shape regulatory frameworks and sustainability expectations for data centre development.

- Singapore aims to achieve carbon neutrality by 2050, supported by a series of national initiatives targeting emissions reduction and energy efficiency[16].
- Japan has set the same 2050 net-zero goal, anchored by its Green Transformation policy, which promotes clean energy and sustainable development[16].
- Australia has committed to a 26–28% reduction in emissions by 2030 (from 2005 levels), with a broader goal of achieving net-zero by 2050[16].

There are varying maturity levels in government policies across Asia Pacific. This suggests that regulations in some countries have yet to keep pace with energy transition needs.

At the same time, other jurisdictions are beginning to tighten their requirements – with Johor, Malaysia, offering a notable example. From June 2024[17], the Johor state government will implement guidelines requiring new data centre operators to demonstrate efforts to use green energy hardware and software, which includes assessment of their power and water efficiency. Data centre operators who fail to demonstrate such efforts risk having their building permission application rejected. This underscores the increasing importance of embedding sustainability from the outset. Compliance will be essential to securing long-term growth and expansion opportunities.

Table 1 Illustration of government's role in driving sustainability targets

Sustainability targets Carbon Neutrality			
Government guidelines for data centres			
Design and construction		**Operations**	
Hardware and design	**Construction**	**Power efficiency targets**	**Water efficiency targets**
For operators, adhering to these standards not only reduces operational costs but also strengthens their commitment to sustainability, aligning operations with both regulatory expectations and environmental responsibilities.	Operators can comply by selecting certified sustainable materials and integrating environmental design strategies, aligning with these guidelines to support global sustainability goals.	Operators will have to adopt energy-saving technologies and optimise operations to meet these standards.	This urges operators to implement innovative cooling systems and water management practices that minimise consumption and mitigate environment impact.
Government support Government incentives and subsidies			

Government support, in the form of incentives and funding, plays a critical role in driving innovation and the adoption of sustainable practices. In Singapore, the government launched the Energy Efficiency Grant in December 2024 to push for adoption of energy efficient compute and IT infrastructure. Similarly, in Australia, the New South Wales Energy Saving Scheme, offers financial incentives to companies undertaking projects to reduce electricity consumption or enhance energy efficiency[18].

Key supply constraints

Significant supply constraints challenge data centre growth

While Asia Pacific's data centre sector is poised for strong expansion, its growth is not without obstacles. These challenges include restricted access to land, limited renewable energy sources, issues related to power reliability, escalating construction costs and water availability.

Table 2 Key constraints challenging data centre growth

	Factors	Impact on the Data Centre Industry
Design and construction	**Land constraint**	As data centres require significant land for development, constraints in land availability can hinder expansion efforts. Regions with ample land may present opportunities, but challenges may arise in densely populated cities, where the presence of data centres is crucial for achieving low latency and ensuring efficient connectivity.
	Construction costs and supply chain disruption	Strong demand causes a shortage of general contractors and services providers (e.g. Mechanical and Electrical). Coupled with global supply chain tightening that could delay materials delivery, construction could be impacted. Rising costs of materials and shortages of skilled labour for data centre construction and operation can significantly impact the feasibility and timeline of new data centre projects.
Operations	**Power downtime**	Reliable access to electricity is vital for operations. Data centres in regions with frequent outages may face higher costs for backup solutions and operational disruptions. In addition, limited grid infrastructure or weak transmission networks can hinder connectivity between energy sources and facilities.
	Water stress levels	Water is essential for cooling systems in data centres, as it helps regulate temperatures and maintain optimal operating conditions. This reliance on water increases consumption, making sustainable water management vital, particularly in regions facing high water stress levels.
	Access to renewable energy	As the demand for sustainable operations grows, data centres must focus on integrating renewable energy sources into their power supply. Limited access can hinder operators' progress toward establishing green and sustainable data centres.

Territories like Chinese Mainland and Malaysia present robust growth opportunities, whereas regions with greater constraints face more subdued growth

Across the diversity of Asia Pacific, each territory presents unique advantages and challenges for data centre operators. No single territory offers a perfect operating environment. The scoring table above assesses each territory across five key supply constraint areas – using a scale of L (Low), M (Medium), and H (High).

Chinese Mainland, Japan, South Korea and Malaysia emerge as favorable markets for data centre investments, with scores indicating relatively fewer constraints, due to manageable land, energy and cost considerations.

Australia and India also offer competitive environments, scoring well due to a balanced management of construction costs and energy accessibility.

Singapore and Hong Kong SAR, however, face higher hurdles, largely influenced by land limitations and stringent energy policies.

For data centre operators, this means site selection becomes increasingly challenging, as they are likely to encounter higher regulatory requirements that necessitate meticulous compliance and planning. Additionally, the limited availability of land drives up costs, making entry into these markets financially demanding.

Table 3 Supply constraint scoring table across selected territories

	Chinese Mainland	Japan	Australia	Singapore	South Korea	Hong Kong (SAR)	India	Malaysia
Land constraint[a]	L	M	L	H	H	H	L	M
Construction and supply chain costs[b]	L	H	M	H	M	M	L	L
Power Downtime[c]	M	L	L	L	L	L	M	M
Water stress levels[d]	M	L	H	H	L	M	M	H
Limited renewable energy access[e]	L	L	L	H	M	H	M	M

a Land constraint is calculated by multiplying the total land area provided by the United Nations Statistics Division by the percentage of 'other' land, as classified by the Central Intelligence Agency. Land classified as 'Other' includes built-up areas, roads and other transportation features, barren land, and wasteland.

b Construction costs are determined using the regional construction cost index by Cushman & Wakefield, where we have taken the mid-range cost based on a mid-specification build.

c Power downtime is assessed using the System Average Interruption Duration Index (SAIDI) as reported by the World Bank Group.

d Water stress levels are derived using the Aqueduct 4.0 water risk framework from the World Resources Institute, which aggregates indicators from the physical quantity, quality, and regulatory and reputational risk categories to measure overall water risk.

e Limited renewable energy access is derived using the average of current (2023) and forecasted (2030) shares of renewable energy in power generation from the International Energy Agency. For Hong Kong and Malaysia, this metric is based on the average of current (2022) and forecasted (2030) share of renewable power sources used in electricity generation, with future projections extrapolated using the growth rate for the Asia Pacific region, excluding China.

f The scoring for India in terms of limited renewable energy access is marked as “M”, however it straddles the boundary between “L” and “M”.

02

Implications to data centre value chain

Data centre operators/owners

The roles of key players in the data centre ecosystem are becoming increasingly interconnected as they collaborate to enable the next phase of growth in Asia Pacific. By understanding emerging trends – particularly the dual impact of AI adoption and the growing energy challenge – stakeholders can better identify opportunities and the path ahead.

Site selection is critical, requiring careful consideration of multiple variables

Choosing where to build remains one of the most strategic decisions for data centre operators and owners. Site selection now requires careful consideration of evolving factors – from key supply constraints to regulatory pushes.

With evolving AI needs, operators need to assess how best to work with key infrastructural inputs at the design stage, while working with stakeholders such as government bodies, energy suppliers, developers and customers.

In addition, operators need to consider various restrictions on access to software and hardware. Uncertain global policy could impact global flow and export of high-tech components to certain markets. This highlights the need for operators to consider chip accessibility in their country.

Design innovation is important for cost and sustainability gains

While governments have been introducing new regulations surrounding design and operating requirements to promote sustainable growth, adoption of state-of-the-art designs and operating systems could provide large cost-savings in the long run.

The use of advanced cooling techniques, innovative servers and rack designs is expected to translate to electricity savings of around 15%[19], with AI-powered systems offering further reductions in operational overhead. Data centre operations and renewable energy generation are converging, and successful operators will need to secure energy supply.

Diversifying clean energy sources will be key to long-term growth

While many large operators have secured long-term Power Purchase Agreements for renewable energy, the expansion of clean energy capacity is not always keeping pace with data centre growth. Grid constraints and infrastructure investment gaps may limit the availability of additional renewable supply.

Operators will need to explore alternative means of energy such as hydrogen or nuclear energy to further supplement their transition towards 100% clean energy. While carbon offsets remain an option, they are often expensive and considered a short-term solution.

Energy storage is another potential solution to complement on-site renewable generation. Ultimately, sustainable growth will require a diversified and adaptive energy strategy.

Developers/construction companies/suppliers

Sustainable practices take centre stage for data centre construction

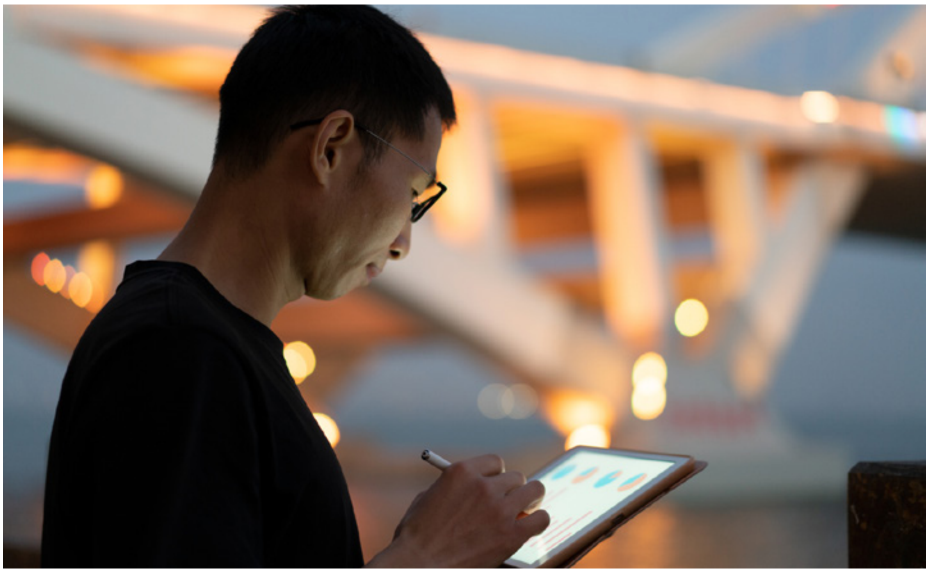
Developers and construction companies play a pivotal role in embedding sustainability into the build. This includes using low-impact materials such as recycled steel and energy-efficient insulation to reduce resource consumption and carbon emissions during the construction phase. These are practical applications that can help developers shift focus towards more eco-friendly, cost-effective solutions.

Developers and suppliers face increasing pressure to deliver at speed

The exponential growth in new data centres across Asia Pacific has led to immense pressure on data centre developers, construction companies and equipment suppliers to expedite project completion. To meet demand, players are increasingly turning to modular construction techniques, which enable faster deployment through prefabricated units. Similarly, suppliers are enhancing supply chain efficiency to ensure timely delivery of critical infrastructure components.

Rising development costs: a crucial consideration for developers and suppliers

Costs continue to rise, from energy and land to raw materials and labour. For developers and suppliers, this means strategic site selection is crucial. Projects must balance development costs with access to essential infrastructure, a challenge that applies equally to data centre operators and owners.



Players in the energy value chain

Innovation is required to meet growing demand

With data centre energy consumption expected to grow significantly, renewable energy alone is unlikely to close the supply-demand gap. This opens up opportunities for clean, alternative energy providers to play a bigger role across the energy value chain.

This can include hydrogen, ammonia and nuclear power (conventional facilities and SMRs), although each face their individual set of constraints or challenges. The renewable energy mix could be diversified to allow for a combination of sources to fill the energy demand.

Transmission and distribution operators are needed to support decentralised, renewable-ready data centres

Transmission and distribution operators can set up renewable energy microgrids for data centres – isolating them from national grids and enabling more self-sustaining operations powered by renewables.

As data centre operators become more flexible in their location choices, grid operators need to ensure a strong and stable transmission infrastructure is in place to support further capacity growth. For example, Tokyo Electric Power Co. Holdings (TEPCO)[20] is planning to invest billions in its grid – building 18 new substations nationwide by 2030.

Investors

ESG-linked investments are becoming financially strategic

While financial return remains the primary criterion for most investors, there is growing recognition that environmental, social and governance (ESG) considerations are tied to long-term value creation. Such financial return can be enhanced through operational efficiency from renewable energy usage and better sustainability-linked financing terms, and at the same time align their investment objectives with investors focusing on financing climate changes.

There are investment opportunities in the broader data centre value chain, such as design and engineering services and facilities management.

Invest in data centre platforms to diversify financial risk

To reduce concentration risk, investors can invest in data centre platforms – companies that develop and operate data centres regionally – allowing for greater diversification across assets, territories and development stages.

This approach requires a clear evaluation of the platform's asset mix, including land banks, in-progress projects and stabilised assets, and how they align with an investor's broader strategy.

Investments into specialised AI-centred platforms may result in AI-adapted pricing models (e.g. flexible pricing in the form of GPU-as-a-service).

Adopt multi-layered financing to meet capital needs

Given the capital-intensive nature of the data centre sector – from land acquisition to full asset stabilisation – a layered financing strategy is an option.

In addition to traditional equity and debt, investors can explore diverse structures tailored to different risk profiles and investment stages.

- Pre-development: Higher-risk capital can be supported by mezzanine financing, bridging loans or private credit.
- Development stage: Project finance can be supplemented by private debt.
- Post-stabilisation: Once operational, assets can be sold into infrastructure trusts or other vehicles suited to investors seeking stable, cash-generating returns at lower hurdle rates. This allows investors to recycle capital and deploy according to their objectives.

Investors more open to different financing options can calibrate their risk-return profile to keep pace with newer forms of capital pool. It can be the key to unlocking future data centre growth opportunities.

Looking ahead

Every player across the data centre ecosystem plays a vital role in shaping the industry's future – from operators and developers to investors and energy providers.

The actions taken today will influence how sustainably, efficiently and equitably the sector can grow.

Navigating the path forward means not only responding to challenges – from energy constraints to regulatory complexity – but actively seeking out opportunities to innovate, collaborate and lead. With bold thinking and coordinated action, Asia Pacific's data centre industry can evolve in ways that support digital progress as well as planetary boundaries.

Appendix

Methodology

Table 1 under Regulatory policies and incentives on page 17

The illustration outlines an overview of sustainability goals within the data centre industry, with an aim of reaching at least carbon neutrality.

1. At the top layer, government establishes a framework for carbon-neutral goals, setting the direction for long-term environmental responsibility.

2. The next layer highlights specific data centre requirements and targets, ensuring that operators align their operational strategies with these overarching goals.

   By following specific **design and construction** guidelines, data centres can achieve greater structural sustainability while optimising resource utilisation. These parameters focus on selecting construction practices and hardware designed to maximise energy efficiency and reduce environmental impact.

   Furthermore, **operational** targets emphasise power and water efficiency, encouraging operators to adopt practices that reduce energy consumption and conserve water.

3. The subsequent layers illustrate the crucial support provided by governments to facilitate the transition to more sustainable data centre practices through a series of incentives and subsidies. These financial measures, such as tax breaks, grants, and subsidies, are instrumental in encouraging investment in energy-efficient technologies and easing the implementation of innovative solutions that contribute to reduced carbon footprints.

Additionally, innovation funds established in various territories further bolster research and development in sustainable data centre technologies, fostering a culture of innovation and promoting the widespread adoption of green practices. This proactive approach by governments underscores their role in driving industry efforts towards achieving carbon neutrality and advancing sustainability goals.

Methodology for Table 3 under Supply constraint scoring on page 19

The scoring table assesses each territory across five key supply constraint areas – using a scale of L (Low), M (Medium), and H (High).

In this scale, L represents the least constraint, while H indicates the highest constraint, relative to other territories. In deriving the overall score, each letter translates numerically as follows: L equals 1, M equals 2, and H equals 3.

By summing these scores for each territory, we derive an overall score that reflects the level of supply constraint faced. A lower total score suggests that the territory experiences fewer overall constraints, potentially offering a more favorable environment for data centre development, whereas a higher score indicates more significant overall challenges.

Sources

1 PwC Analysis based on information collated from Cushman & Wakefield, Press Search, Citigroup

2 Statista, "Number of data centers in the Asia-Pacific region as of April 2025, by country or territory", 2025, https://www.statista.com/statistics/1415287/apac-data-center-number-by-country/

3 The Straits Times, "Sizzling valuations are no bar for Asia data centre deals as AI growth beckons", 04.12.2024, https://www.straitstimes.com/business/sizzling-valuations-are-no-bar-for-asia-data-centre-deals-as-ai-growth-beckons

4 Microsoft, "Accelerating Japan's growth with AI", 27.03.2025, https://news.microsoft.com/apac/2025/03/27/accelerating-japans-growth-with-ai/

5 TechinAsia, "SoftBank to build $677m AI data center in former Sharp factory", 14.03.2025, https://www.techinasia.com/news/softbank-to-build-677m-ai-data-center-in-former-sharp-factory

6 JLL, "Japan data centres: algorithm, resilience and carbon neutral", 2024, https://www.jll.co.kr/en/trends-and-insights/research/japan-data-centres-algorithm-resilience-and-carbon-neutral#:~:text=At%20present%2C%20over%2050%25%20of,in%20other%20regions%20in%20Japan.

7 Japan External Trade Organization, "JETRO Invest Japan Report 2023", 2025, https://www.jetro.go.jp/en/invest/investment_environment/ijre/report2023/ch3/sec6.html

8 Invest India, "India's internet surge: Catalyzing change in the telecom landscape", 20.08.2024, https://www.investindia.gov.in/blogs/indias-internet-surge-catalyzing-change-telecom-landscape#:~:text=Per%20a%20recent%20TRAI%20report,(CAGR)%20of%2054%25.

9 Hans India, "India's Urban Water Crisis 2025: Which Cities Are Fast Running Out of Water?", 13.05.2025, https://www.thehansindia.com/life-style/indias-urban-water-crisis-2025-which-cities-are-fast-running-out-of-water-970383;
World Resource Institute, 2025, International Centre for Sustainability, 06.02.2025, https://icfs.org.uk/the-looming-water-crisis-a-threat-to-indias-future/

10 ChannelNewsAsia, "Johor's data centres getting a boost from the Singapore factor; water, power remain bottlenecks", 06.05.2024, https://www.channelnewsasia.com/asia/malaysia-johor-data-centres-nvidia-ytl-kulai-sedenak-sez-us-china-trade-war-4310496

11 Infocomm Media Development Authority (IMDA), "Four data centre proposals selected as part of pilot Data Centre Call for Application ("DC-CFA")", 14.07.2023, https://www.imda.gov.sg/resources/press-releases-factsheets-and-speeches/press-releases/2023/four-data-centre-proposals-selected-as-part-of-pilot-data-centre-call-for-application

12 World Economic Forum, "How power-positive data centres can unlock AI's potential while transforming communities", 19.09.2024, https://www.weforum.org/stories/2024/09/how-power-positive-data-centres-can-unlock-ai-s-potential-while-transforming-communities/

13 International Energy Agency, "Energy demand from AI", 2025, https://www.iea.org/reports/energy-and-ai/energy-demand-from-ai

14 CBRE, "Australia's Data Centres, 10.2024, https://mktgdocs.cbre.com/2299/51ad65f2-603f-4db2-9ad1-d37671aa3a68-657507533/v032024/australia-data-centres-2024.pdf

15 Jakarta Globe, "US Agrees to Help Indonesia Develop Small Nuclear Reactor", 13.11.2024, https://jakartaglobe.id/news/us-agrees-to-help-indonesia-develop-small-nuclear-reactor; S. Rajaratnam School of International Studies (RSiS), "CO22125 | Small Modular Reactors in the Philippines' Journey Toward Nuclear Energy", 05.12.2022, https://rsis.edu.sg/rsis-publication/rsis/small-modular-reactors-in-the-philippines-journey-toward-nuclear-energy/; Bangkok Post, "Officials contemplating nuclear power", 17.07.2024, https://www.bangkokpost.com/business/general/2830797/officials-contemplating-nuclear-power

16 National Climate Change Secretariat (NCCS), "Singapore Commits to Achieve Net Zero Emissions by 2050", 25.10.2022, https://www.nccs.gov.sg/media/press-releases/singapore-commits-to-achieve-net-zero/ ; Japan Ministry of Economy, Trade & Industry (METI), "Green Growth Strategy Through Achieving Carbon Neutrality in 2050", 17.10.2022, https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/index.html ; Climate Change Authority, "2035 Emissions Reduction Targets", 25.10.2024, https://www.climatechangeauthority.gov.au/2035-emissions-reduction-targets#:~:text=A%20commitment%20to%20reduce%20greenhouse,net%20zero%20emissions%20by%202050

17 Straits Times, "Johor rejects nearly 30% of data centre applications to protect local resources", 19.11.2024, https://www.straitstimes.com/asia/se-asia/johor-rejects-nearly-30-per-cent-of-data-centre-applications-to-protect-local-resources

18 IMDA, "Request for Information (RFI) – Energy-Efficient Data Centre IT Equipment", 27.02.2025, https://www.imda. gov.sg/proposal-submission/request-for-info-energy-efficient-data-centre-it-equipment#:~:text=The%20Energy%20 Efficiency%20Grant%20(EEG,approved%20energy%2Defficient%20IT%20equipment ; NSW Government, "Energy Savings Scheme", 10.06.2025, https://www.energy.nsw.gov.au/nsw-plans-and-progress/regulation-and-policy/energy-security-safeguard/energy-savings-scheme

19 Tierpoint, "How data center energy efficiency promotes savings", 01.12.2023, https://www.tierpoint.com/blog/data-center-energy-efficiency/

20 Nikkei Asia, "Japan's TEPCO to invest $3.2bn in power grid to meet AI demand", 30.08.2024, https://asia.nikkei.com/Business/Energy/Japan-s-TEPCO-to-invest-3.2bn-in-power-grid-to-meet-AI-demand

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