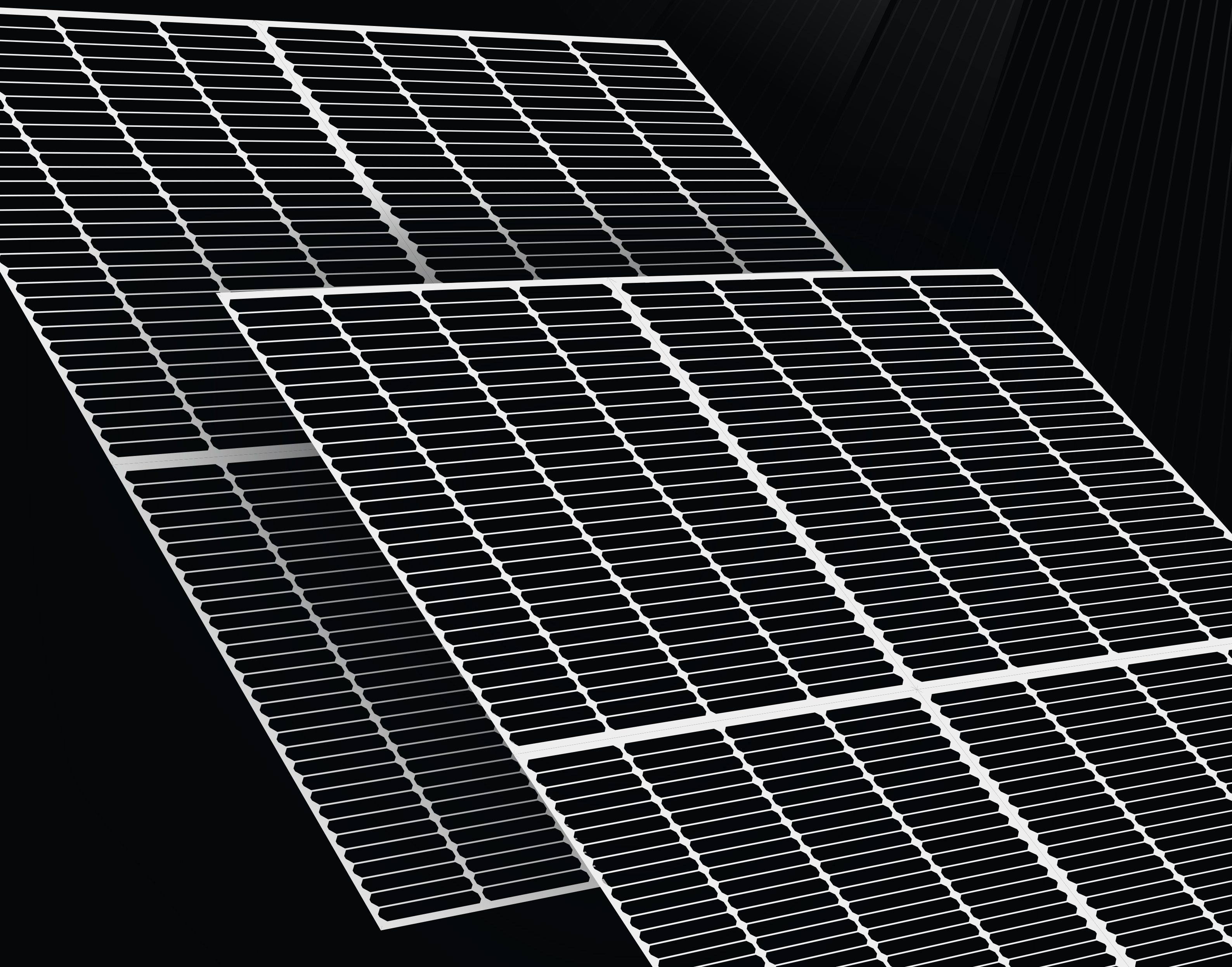
POWERING A CLEAN ENERGY FUTURE



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INTRODUCTION

Data centres are playing an important role in moving towards 24/7 clean energy

Forging a pathway to 24/7 clean energy is critical for a zero-carbon future. The potential to tap clean energy every hour of the day in the Asia-Pacific & Japan[1] (APJ) region has yet to be realised. To achieve it will require collaboration in six key areas which will be explored in this report.

Hyperscale data centres (HDCs) can play a vital role in this transition as they scale operations in response to the demand for cloud infrastructure and continue to champion the use of renewables.

The United Nations, the international organisation that supports sustainable development and climate action, continues to advocate for a reduction in greenhouse gas emissions at an accelerated speed to meet the Paris Agreement commitment made by almost 200 countries. In response, companies around the world have made ambitious commitments to reduce these emissions and, in many cases, achieve net zero by 2050.

The technology sector has led the charge, with large companies like Google, Microsoft, Amazon, ByteDance and Oracle among the first to commit to bold climate targets[2] including setting the aspiration to procure 100% clean energy. Google and Microsoft have already committed to achieving 24/7 clean energy across their operations by 2030. These companies have made more aggressive commitments because their carbon intensity is usually much lower than other sectors.

To achieve these global ambitions, unique approaches need to be adopted at a regional, country and city level based on available resources. Furthermore, it will require innovation, collaboration and partnerships across industries and borders. APJ, in particular, faces the challenge of low availability of carbon-free energy and this report provides a range of opportunities to solve these challenges.

[1] The western rim of the Pacific including Japan and excluding China
[2] Google Sustainability website, Microsoft Sustainability website, ByteDance 'ByteDance Commits to Operational Carbon Neutrality by 2030' Media release, March 2023; Amazon Sustainability website

THE IMPACT OF HYPERSCALE DATA CENTRES

Driven by the most innovative and forward-thinking global businesses, cloud infrastructure in all its forms has become a foundational component of all societies and industries. HDCs are the critical digital infrastructure that supports the growth of cloud from large cloud service providers (CSPs). They play an essential role in digitalising economies, enabling CSPs to make their digital products and services available to communities. These critical assets are expected to double between 2022 to 2030 (measured by their power consumption) in the U.S. market alone[3].

According to the United Nations, 24/7 carbon-free energy, or clean energy, means that every kilowatt-hour of electricity consumption is met with carbon-free electricity sources, every hour of every day, everywhere.

As people move their consumption habits online, demand for HDCs will continue to grow and, in turn, so too will the amount of electricity required to manage this critical infrastructure. It has been estimated that data centres currently account for approximately 1% of global electricity consumption[4].

To minimise these emissions, HDCs have a unique opportunity to implement a 24/7 clean energy model. By doing this, they will be significantly advancing decarbonisation worldwide, defining standards, driving energy innovation and accelerating progress to net zero.

About this report

This report intends to build momentum towards achieving 24/7 clean energy in APJ, and the role HDCs can play in this energy transition. It analyses the potential technology pathways, costs and sourcing options for 24/7 clean energy by 2030 across four key growth markets – Australia, Singapore, Japan and Malaysia.

The report outlines:

1. The move from volume matching to 24/7 clean energy
2. The challenge of achieving 24/7 clean energy in APJ
3. How HDCs are responding to the challenge
4. The six 'unlocks' to achieve 24/7 clean energy goals in APJ
5. Building the ecosystem for 24/7 clean energy in APJ

[3] McKinsey & Company 'Investing in the rising data center economy' Report, January 2023
[4] IEA 'Data Centres and Data Transmission Networks' Report, September 2022

1. THE MOVE FROM VOLUME MATCHING TO 24/7 CLEAN ENERGY

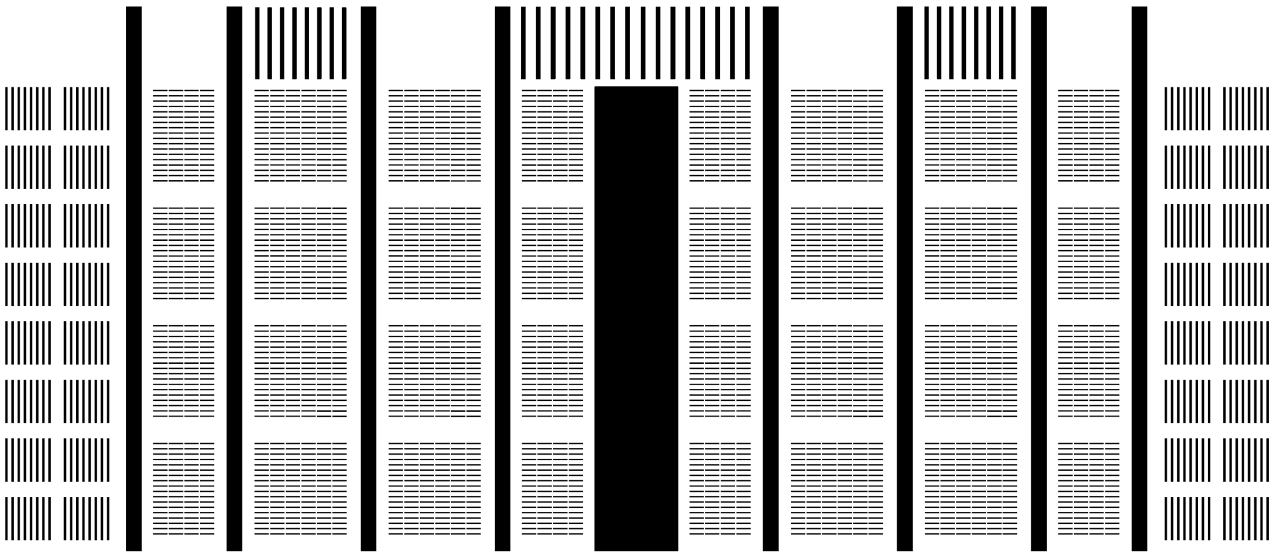
HDCs remain committed to investing heavily in energy efficiency initiatives. For example, AirTrunk is implementing a liquid cooling technology at its JHB1 facility reducing energy consumption by up to 20%. In sourcing energy, the sector continues to prioritise renewable energy. A large majority of the 31.1 gigawatts (GW) of corporate power purchase agreements (PPAs) signed in 2022 were sourced by only three major cloud players (Amazon, Microsoft and Google)[5].

The effectiveness of these efforts is evident with data centre workloads increasing by 340% between 2015 and 2022, and their energy use only increasing by between 20 to 70%[6].

When it comes to renewables, many CSPs and HDCs have set 100% renewable energy targets. AirTrunk, as an example, has committed to working with its customers to have 100% of electricity consumed at its data centres matched with clean energy by 2030. Still, there remain challenges to achieving this including the limited availability of carbon-free energy in many markets across APJ, as well as annual volume matching targets relying heavily on fossil fuels during hours or days when renewable energy is not sufficiently available.

The International Energy Agency (IEA) recently observed that 'goals based on annual matching of electricity or only targeting emissions do not deliver all the technologies that will be needed as power systems decarbonise[7]'.

To transition towards a fully decarbonised power system, the aspiration should be to deliver every kilowatt-hour of electricity from carbon-free clean energy sources, every hour of every day.



[5] BloombergNEF 'Corporations Brush Aside Energy Crisis, Buy Record Clean Power', February 2023
[6] IEA 'Data Centres and Data Transmission Networks', July 2023
[7] IEA 'Advancing Decarbonization through Clean Electricity Procurement', November 2022

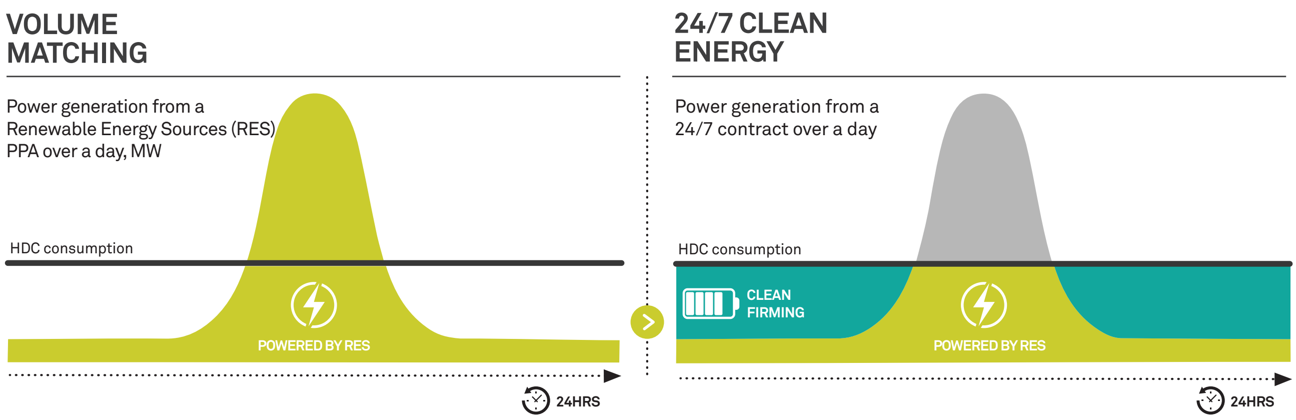
Figure 1 shows the difference between volume matching over a day or a year, and 24/7 clean energy. In volume matching, the HDC may not use all the renewable energy available to it in periods of high sunlight or wind. That excess is 'banked' against other times when the HDC draws on fossil-fuel grid energy, so that the HDC can rely on 'net' 100% clean energy.

For 24/7 clean energy, the hourly matching of consumption and supply requires carbon-free electrons regardless of weather conditions. As pointed out by researchers at the Princeton University Zero Lab, 24/7 clean energy needs 'dispatchable' carbon-free technologies such as batteries, long-duration energy storage (LDES), hydrogen or biogas, and many of these are not yet available or affordable at scale[8].

The APJ region is projected to account for half of the global colocation market by 2026[9]. As a leading HDC operator[10], along with setting its own 100% carbon-free energy target, AirTrunk has joined a global group of companies, policymakers and investors in committing to the 24/7 Carbon-Free Energy Compact. The Compact is coordinated by the United Nations and Sustainable Energy for All.

By pursuing 24/7 clean energy, HDC operators can be invaluable partners for the clean energy sector. In aiming for 100% volume matching, the global tech sector has been one of the strongest buyers of renewables[11], helping to dramatically accelerate the downward trend of prices and catalyse massive investments in renewable energy. With 24/7 clean energy targets, the tech sector could also accelerate the deployment of dispatchable carbon-free energy solutions.

Figure 1: 24/7 a significant step up from volume matching



[8] Xu Q and Jenkins DH 'Electricity System and Market Impacts of Time-based Attribute Trading and 24/7 Carbon-Free Electricity Procurement', September 2022
[9] Structure Research Market Share Report Series, Global Markets February 2022
[10] 'HDC operators' mean large tech corporations who operate their own HDCs, as well as those like AirTrunk who lease HDCs to them
[11] American Clean Power NEW REPORT: Corporations Purchased More U.S. Clean Energy in 2022 Than Ever Before, Media Release, January 2023

2. THE CHALLENGE OF ACHIEVING 24/7 CLEAN ENERGY IN APJ

While there is a growing amount of research investigating the pathway to 24/7 clean energy on a 100% hour-by-hour basis, more information is needed on how to achieve this in the APJ region.

In Europe, if you are buying 100% renewables, you may already be sourcing clean energy more than 60% of the time[12]. Princeton University and Google confirm similar findings for the United States[13]. In the APJ region however, the cost of reaching even 90% clean energy is likely to be more expensive than in Europe or the U.S.

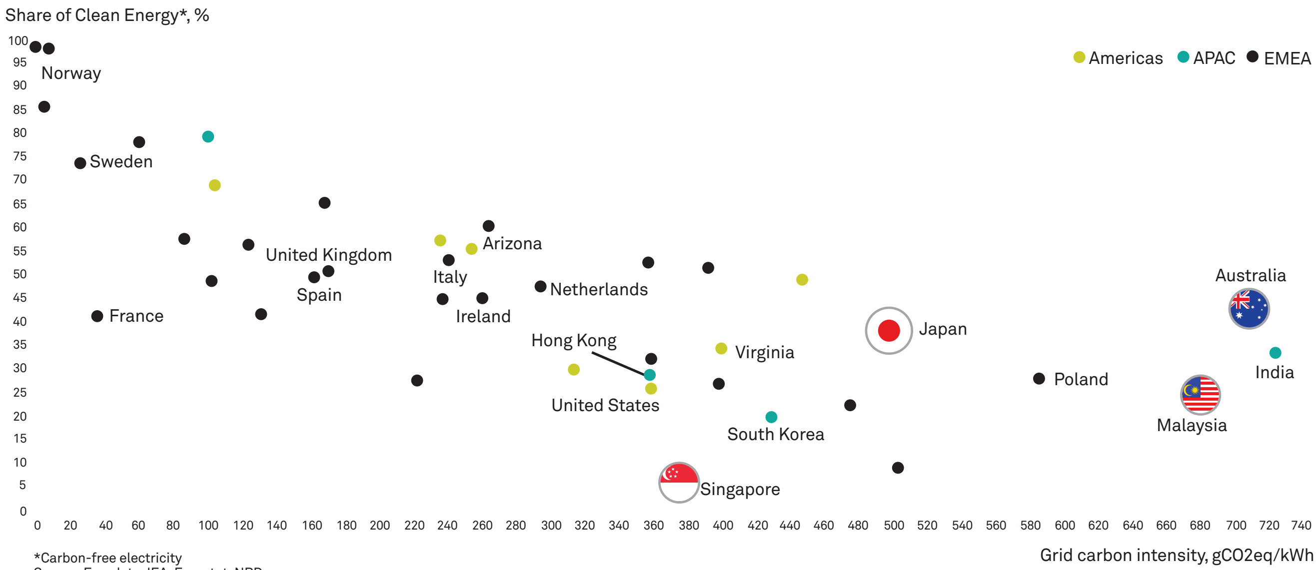
The cost in each APJ country is driven by two factors: the cost of the renewable resources available; and the cost of carbon-free, dispatchable technologies to maintain, or firm, the intermittent renewable energy resources for a long period of time. The first largely relates to volume matching; the second will, if managed, set benchmarks in 24/7 clean energy.

1. The cost of renewable resources available. Sourcing renewable energy is typically more expensive in the APJ region due to resource limitations, financing and technology costs[14]. As a result, for example, solar in Japan is currently US$87 per megawatt hour (MWh), compared to US$61 in Germany and US$55 in California[15]. In addition, 'new' renewable generation opportunities need to be identified, given carbon-free sources account for only 5-40% of the total power produced in APJ grids, against 40-100% in Europe: see Figure 2.

Australia is an exceptional case in the APJ region – it has abundant solar and wind resources with capacity factors in some areas over 30% and 40% respectively, yet it is still highly reliant on coal for power generation. Nonetheless, the cost of achieving even annual volume matching in Australia (~US$60/MWh) is significantly cheaper than achieving it in Japan (~US$85) or Malaysia (~US$80): see Figure 3 on the next page.

Given land scarcity constraint, Singapore must import most of its renewable power through expensive undersea interconnections, so the cost of volume matching is expected to start above ~US$150.

Figure 2: Grid carbon intensity across Asia Pacific and Japan is significantly higher than Europe



*Carbon-free electricity
Source: Enerdata, IEA, Eurostat, NRD

[12] Iegor Riepin, Tom Brown, 'System-level impacts of 24/7 carbon-free electricity procurement in Europe', October 2022
[13] Xu Q, Manocha A, Patankar N and Jenkins JD 'System-level impacts of 24/7 carbon-free electricity procurement', November 2021
[14] Engie Impact How The Tech Sector Can Drive Renewable Energy Opportunities In APAC
[15] International Renewable Energy Agency 'Renewable Power Generation Costs in 2021', July 2022

2. The cost of carbon-free, dispatchable technologies to firm the intermittent renewable energy resources. The technologies themselves vary in cost and availability and include pumped-hydro, nuclear, biogas, batteries and LDES technologies. The nature and availability of these technologies in each country determine the cost premium for hourly matching above annual volume matching.

Some regions in Australia (e.g. New South Wales, Victoria) have access to relatively cheap pumped hydro resources to firm its already competitive renewables, leading to a premium of ~25% or ~US$15/MWh.

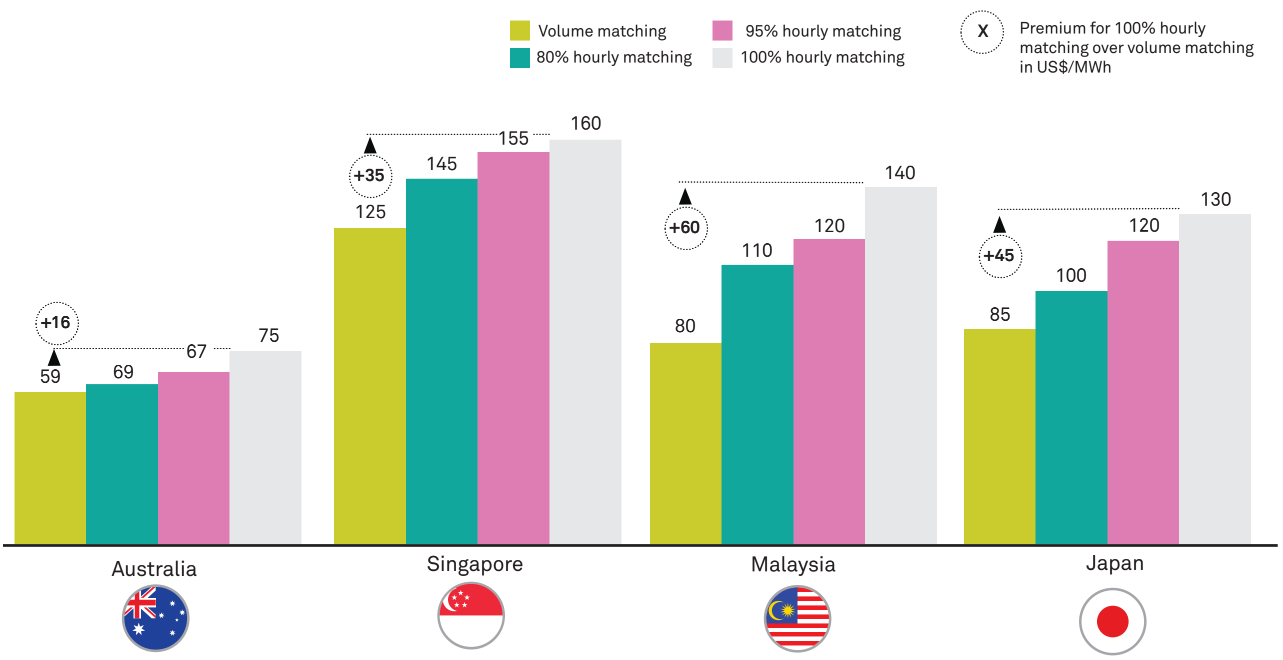
Singapore is next best placed as far as the firming premium is concerned, assuming it can draw more heavily on its international supplies, with a premium of ~US$35.

Malaysia and Japan are likely to rely on more expensive green hydrogen and battery storage technologies, leading to premiums of US$45-60.

For India and Indonesia, the IEA similarly suggests that significant new forms of clean dispatchable energy are needed to lift clean energy matching already from 60% to 80% of the time on the path towards 100% matching[16].

Figure 3 indicates how the firming cost can climb exponentially the closer you get to 100% clean energy, with the 'last mile' of 5-10% needing more advanced firming and storage technologies than are currently available. For example, in Malaysia, it would cost an extra US$10/MWh to move from 80% to 95% hourly matching, yet the last 5% increase would cost an additional ~US$20/MWh.

Figure 3: Excess cost to deliver volume matching and hourly matching in four APJ countries[17]



[16] IEA 'Advancing Decarbonisation through Clean Electricity Procurement', November 2022
[17] McKinsey & Company analysis

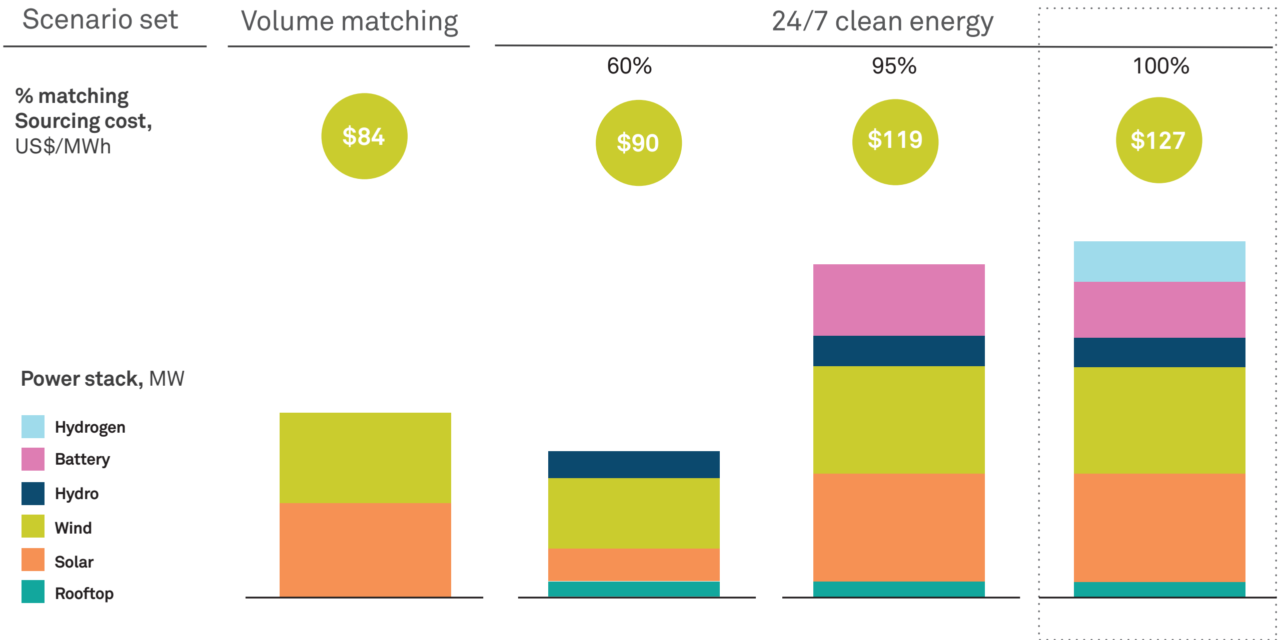
Figure 4 contains the volume and hourly matching costs for Japan, with a breakdown of the contribution by each technology. HDCs could secure annual volume matching from solar and onshore wind for a cost of ~US$84/MWh, and hourly matching 60% of the time for a similar ~US$90/MWh with some hydro and batteries. However, costs increase markedly to ~US$120/MWh for the 95% target and ~US$130/MWh for the 100% goal.

Well-tested existing technologies are capable of bridging most of the firming gap. However, achieving 100% matching in most markets will require innovative carbon-free dispatchable technologies such as green hydrogen-powered turbines, or LDES.

In Japan, those technologies would contribute to over 25% of the ultimate power sources, yet they are not currently available at commercial scale and still relatively expensive[18]. In Europe and North America, by comparison, development of both technologies is more advanced, and they are now supported by comprehensive policy packages, for example the *U.S. Inflation Reduction Act* of 2022.

Given the much lower starting position in APJ, considerable actions would be required to decarbonise the region's power grid. Section 5 of this report outlines the encouraging signs that demonstrate that the challenge can be overcome.

Figure 4: Technology mix required to deliver 24/7 clean energy for a HDC in Japan



[18] The LDES Council reached a similar conclusion when looking at the premium required to shift from 80% hourly matching to 100% hourly matching

3. HOW HDCs ARE RESPONDING TO THE CHALLENGE

Market conditions are favouring clean energy investment, led by the HDC industry. Corporate PPAs for renewables have proliferated in recent years – for example, Taiwan enabling companies to source renewables directly in 2017, Korea following in 2021 and Japan in 2022; Malaysia recently launched a pilot PPA programme in 2023. With the regulatory environment opening and commercial offtake structures maturing, the APJ region is projected to attract more than 25% of global renewable capacity investment over the next three decades[19].

HDC operators have also begun to innovate to deliver 24/7 clean energy. In November 2022, AirTrunk announced a first-of-its-kind renewable energy solution in Hong Kong that will match Microsoft's data centre electricity consumption with local renewable energy certificates. The solution will be directly linked to the West New Territories (WENT) Landfill Gas Power Generation Units of CLP Power and features hourly matching of renewable generation to data centre electricity consumption. The facility generates 100% of power with landfill gas captured at the WENT landfill site and is issuing RECs for all the power we receive.

As HDC operators partner with the energy sector to test and build-out 24/7 clean energy solutions, they are well positioned to be catalysts for accelerating the technologies, commercial structures and policies needed in the APJ region due to a number of factors:

SCALE THAT MATTERS	HDCs are an essential asset for economies as they rapidly digitalise and they, in turn, rely on increasing amounts of clean energy. Their scale and permanence are a strong foundation for long-term supply agreements with energy providers upon which 24/7 clean energy mechanisms and technologies can be based.
CONSTANT DEMAND PROFILES	HDCs have a strong commercial incentive to find 24/7 clean energy alternatives given their constant load profiles, with little variation in energy demand between hours or seasons. Such a flat load profile is subject to price risks outside of the midday solar peaks.
COMMERCIAL AND TECHNICAL KNOW-HOW	HDCs have the commercial and technical knowledge to partner in complex, large-scale and long-term energy projects.
TRACK RECORD AND KNOWLEDGE BASE IN CLEAN ENERGY INVESTMENT	HDCs have long collaborated with the energy sector in developing clean energy, both by enabling renewable project investments and supporting appropriate regulatory reform.

This positions HDC operators as ideal partners for the energy transition as they drive demand for 24/7 clean energy solutions. In doing so, the concept of additionality is important, meaning that this demand results in new firming capacity and technologies being added to the system, given limitations around existing capacity. This is consistent with the approach to renewable sourcing where many corporates and data centres already follow the additionality principle. Additionality ensures that 24/7 clean energy targets benefit the wider market, with HDCs helping to move the market along.

[19] IEA 'World Energy Outlook Investment Outlook', October 2022

4. SIX UNLOCKS TO ACHIEVE 24/7 CLEAN ENERGY GOALS IN APJ

Narrowing the cost gap of clean energy 24 hours a day will be key to driving wide adoption among HDC operators and other large energy consumers in the APJ region. As noted above, this requires two steps. The first is ensuring there is enough renewable energy available in the APJ region, either directly or through the grid, at a reasonable price. The second is overcoming the intermittency of solar and wind generation with a range of innovative carbon-free firming technologies.

There are six actions required to reduce the cost to unlock the 24/7 clean energy potential that are particularly relevant across APJ markets.

With appropriate government intervention and industry collaboration, alongside these actions, the potential for 24/7 clean energy across APJ can be accelerated dramatically.

01 Increase and strengthen grid interconnection between APJ markets

02 Accelerate 'green molecules' and other new firming and storage technologies

03 Diversify the portfolio with local firming solutions

04 Leverage on-site infrastructure to support local grids and power markets

05 Shift non-latency-sensitive loads to lower cost markets

06 Start the discussion to achieve 24/7 clean energy in a cost-optimal way

01 Increase and strengthen grid interconnection between APJ markets

The larger an area is, the more likely that sunny or windy conditions in one part can make up for still and cloudy conditions in another. A portfolio of renewable sources across a large area is therefore a low-cost solution to deliver 24/7 clean energy.

For example, the 10,000km of network interconnections planned for Australia's east coast National Energy Market (NEM) will offer 'Europe like' portfolio effects: it will make firmed 100% clean energy in Sydney 5-10% cheaper than in locations such as Queensland and Darwin[20], despite those locations being closer to stronger renewable resources.

Power grids in the APJ region currently have limited international connections. Singapore's pilot to import 100MW of clean energy from Laos through Malaysia is a positive sign in advancing interconnection, with longer term plans and work underway for up to 4GW in total renewable imports by 2035. Relying on green hydrogen imports to supply baseload power by 2030 would increase the overall cost of generation by more than 30% compared to importing renewable power from neighbouring countries.

Stronger grid interconnections can also support bi-directional energy flows. For example, in Vietnam, an effective grid connection would enable solar power to be exported to a 'still' north, and wind power to be exported to a 'dark or cloudy' south.

International or large intranational power interconnections often need years of government-to-government negotiations. For many potential interconnections, such as between the Association of Southeast Asian Nations (ASEAN), there needs to be a thorough assessment of the value at stake, and work towards the mechanisms and market signals that would enable cross-border power trade.

02 Accelerate 'green molecules' and other new firming and storage technologies

Where interconnection is not viable, shipping 'green molecules' of hydrogen or ammonia produced with carbon-free energy may support the transition, with green hydrogen able to store clean energy indefinitely.

Potential LDES technologies such as redox flow batteries, metal-air batteries, and thermal and compressed air energy storage, can also store energy for multiple hours or days.

However, most of these firming and storage solutions are not yet commercially viable, with the process technology still in development. If key players in the region can solve these challenges by 2030, LDES and green hydrogen could reduce the overall cost for 24/7 clean energy in markets like Japan by as much as 35%, from US$200+/MWh to ~US$130/MWh[21]. For green hydrogen, large investments in infrastructure to produce, ship, convert and safely distribute volatile liquid hydrogen will be required.

While global research may solve the technical problems, local and regional policies may be needed to support pilot schemes and regional adoption. For example, wind and solar photovoltaic only started growing at scale after legislators introduced attractive feed-in tariffs. The US *Inflation Reduction Act* of 2022 is now supporting firming technologies in the same way. Unless similar policies are adopted in the APJ region, investment and talent may be diverted from the region to other more advanced regions[22].

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[20] McKinsey & Company modelling
[21] McKinsey & Company modelling
[22] Energy Networks Australia '2022 Energy Insider', October 2022

03 Diversify the portfolio with local firming solutions

Some APJ markets already have valuable resources and technologies that can be better leveraged to firm renewable power including:

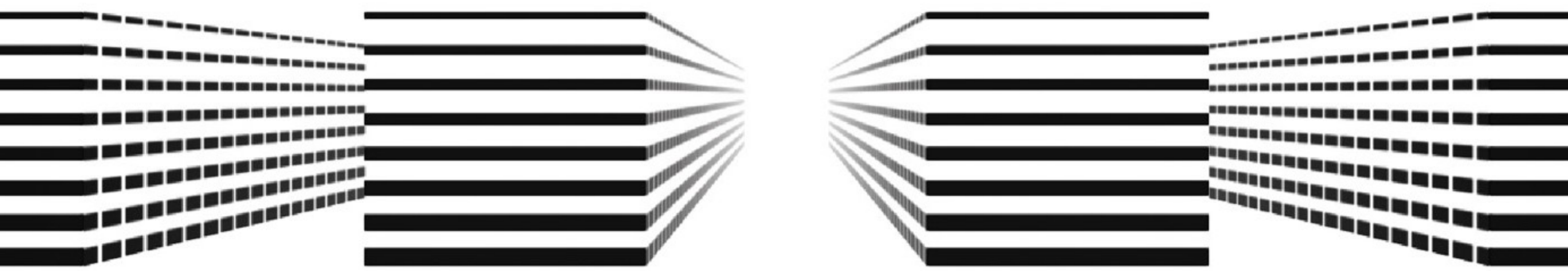
- **Biogas in Malaysia and biomass in Indonesia.** In Malaysia, biogas is not yet widely converted into electricity and fed into the grid, despite significant natural potential, due in part to the difficulty in aggregating smaller, distributed pockets of biogas for conversion. If that bottleneck were overcome, biogas could reduce 24/7 clean energy cost by ~15% in Malaysia compared to where green hydrogen or LDES alone are used for firming[23].

- **Hydropower** could be leveraged where appropriate, with environmental approvals and social license constraints considered. For example, large pumped storage hydro assets like Snowy Hydro in Australia may help to achieve a 24/7 clean energy target at more than 10% lower total sourcing cost than with other technologies[24] (e.g. green hydrogen).

- **Geothermal energy in Indonesia and Philippines.** Geothermal energy may be a relatively lower-cost option for constant clean energy generation in these markets (~US$70/MWh) – and 24/7 clean energy targets may create the right incentives for its development in suitable locations[25].

- **The nuclear industry in Japan** may be able to add small modular reactors to its portfolio to deliver power at a reasonable US$80/MWh[26]. Elsewhere, where there is no existing industry and regulatory institutions, the cost and timeline needed to get new projects approved and built may be prohibitive.

The commerciality of leveraging these and other potential firming opportunities should be fully explored.



[23] McKinsey & Company modelling
[24] McKinsey & Company modelling
[25] International Renewable Energy Agency, 'Geothermal: the solution underneath', Policy Paper, 2021
[26] Wood Mackenzie, 'Small modular nuclear reactors could be key to meeting Paris Agreement Targets', Media Release, August 2021

04 Leverage on-site infrastructure to support local grids and power markets

To protect against interruptions in grid power supply, HDCs typically use batteries that kick in immediately, followed by diesel generators to run until grid supply is restored. Where this is operated with a 'grid interactive' capability, HDCs can provide balancing support to local power systems, enabling a higher renewable penetration on the grid.

In a net zero future, we expect diesel generators to be gradually replaced by onsite energy storage systems (BESS or LDES), or potentially hydrogen fuel cells or generators operating on carbon-free fuels. With carbon-free backup power available on site, HDCs would rely less on dispatchable offsite firming solutions, and the cost of achieving 24/7 clean energy targets could fall by as much as 10%.

Backup would not only consider the availability of utility supply, but also the carbon content at the time of utility supply. Meanwhile grid support and demand side flexibility could still be offered, this time carbon-free.

05 Shift non-latency-sensitive loads to lower cost markets

HDC loads are typically highly sensitive to factors such as latency requirements, cloud network architecture and data sovereignty regulation. As a result, HDCs often need to be physically located in an availability zone close to the end data or application user.

Some applications, such as artificial intelligence or video streaming, may be more flexible in terms of location given the strong fibre connectivity between markets. With a wider push towards 24/7 clean energy targets, shifting flexible server loads to locations with lower cost of achieving the target may become a growing consideration. For example, shifting 20% of the compute and energy load from Singapore to Perth or Malaysia would reduce overall cost for 24/7 clean energy by ~10% in 2030, according to our modelling results. This may lead to growing optimisation of energy loads across locations depending on the type of underlying server compute demand and the cost of meeting clean energy commitments.

06 Start the discussion to achieve 24/7 clean energy in a cost-optimal way

Although there are many carbon-free firming technologies available, it only takes one of these technologies to reach commercial scale to make significant progress towards achieving 24/7 clean energy.

While it is not yet clear how some of these technology costs may mature, governments offering subsidies or premiums will drive forward the commercial viability of these technologies. In addition, local industry players aiming to achieve 24/7 clean energy in the most cost-optimal way should investigate the different options available in the coming years and align on building the ecosystem to support the optimal solution. For example, in the case of green hydrogen, investments in storage and distribution infrastructure will be required.

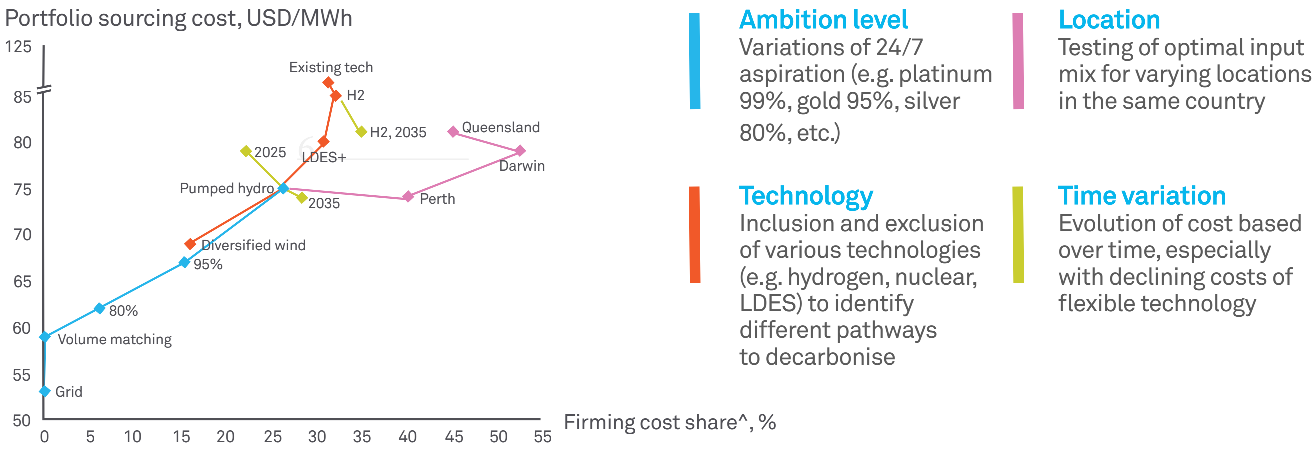
Figure 5 below shows an illustrative map of decarbonisation pathways to reach the clean energy procurement target, categorised into four main decision points to consider: ambition levels, technology options, data centre location, and time horizon to achieve 24/7 clean energy.

The graph shows the respective sourcing costs for achieving 24/7 clean energy for a data centre in Australia with different solution parameters, and highlights the key cost sensitivities across the decision points. For example, the blue line suggests that reducing the target matching percentages reduces sourcing costs. Conversely, meeting the target with existing technology only increases the sourcing costs. The graph also highlights the extent to which total sourcing costs are driven by firming cost. For example, in Darwin the share is highest due to lack of portfolio effects and the concentration of renewable resources. The lower cost of renewable needs to be considered against the higher firming requirements.

Stakeholders need to align on the right set of technologies to support, the right balance of cost premium and how that may change over time, to achieve the targets and the level of target ambition.

To reach that alignment, more dialogue and analysis are required, especially in APJ where the discussion is in its infancy.

Figure 5: Potential pathways to reach 24/7 clean energy for a HDC in NSW, Australia



^Source: Flexible capacity cost share of total cost, including batteries, LDES, hydrogen, pumped hydropower and reservoir-based hydropower

5. BUILDING THE ECOSYSTEM FOR 24/7 CLEAN ENERGY IN APJ

While the above 'unlocks' will help to drive down cost across APJ markets, these needs to align with developing the policy and commercial ecosystem to operationalise 24/7 clean energy for energy suppliers and large energy consumers, such as HDCs.

Reaching 24/7 clean energy in the APJ region will take strong leadership from energy consumers, collaborating with energy suppliers and policy makers, including to:

A

Align on standards to define and trace time-based energy certificates. Many of the certification standards for renewable or clean energy in APJ do not currently include tracing the time of generation (time-stamping). Energy consumers can refer to guidance from industry initiatives such as EnergyTag and software solution providers[27]. Alternatively, time-stamping could be built into government-administered certificate schemes – notably the Australian government has recently proposed future renewable energy certificates to include time-stamping[28]. In Hong Kong, AirTrunk sources a new hourly Renewable Energy Certificate from the utility provider, CLP Power.

B

Innovate commercial structures to enable sourcing. Large energy consumers need a greater range of commercial options to build up a portfolio of generation and firming sources. While corporate PPAs are increasingly common to source renewables in APJ markets, these consumers would need to be able to contract other forms of dispatchable clean energy solutions, whether that is green hydrogen PPAs or contracting energy from hydro power, nuclear energy or storage. This could include energy providers innovating solutions to commercially aggregate portfolios of technology solutions (e.g. round-the-clock renewable PPAs developed in India). In addition, PPAs could start incorporating the benefits of the onsite HDC backup facilities (e.g. onsite batteries), which, when considered as part of the portfoliotdeliver 24/7, could increase reliability and lower costs for all parties.

C

Build partnerships to drive commercialisation of new technologies. As shown in Figure 5, in many APJ markets, achieving 24/7 clean energy will require new technologies such as hydrogen and LDES. Highlighting early demand for these nascent technologies will help to accelerate and de-risk the finance required for broader adoption. HDCs have the scale, expertise and appetite to be valuable partners to trial, and if successful, invest in the acceleration. Their projects may also benefit from grant schemes for which future commercial demand is a pre-condition.

[27] Examples include FlexiDAO, nZero, Enosi or Powerledger
[28] Australian Department of Climate Change, Energy, the Environment and Water, 'Policy Position Paper for renewable electricity certification', December 2022

CONCLUSION

Most major economies in the APJ region have set ambitious renewable and decarbonisation targets for 2030, on the path to net zero by mid-century. To achieve these targets, they will need all the energy storage, green hydrogen and other firming technologies they can develop.

By seeking to eliminate its power emissions by 2030 through 24/7 clean energy, the HDC industry has a unique opportunity to collaborate with the tech and energy sector as a powerful conduit to accelerate the policies, technologies and commercial structures needed for this APJ energy transition. This makes them the ideal partner to accelerate renewables strategies.

Fifteen years ago, governments and corporations began setting renewable targets and in doing so, helped stimulate the market for renewable generation. Now, the HDC industry in APJ, supported by regional policy makers and regulators, can lead the way and move the market forward on the firming and storing technologies that renewable energy generation now needs to achieve 24/7 clean energy.

Strong collaboration and intent are needed so the industry can unlock the potential of 24/7 clean energy across the region. By prioritising the enablement of innovative strategies like 24/7 clean energy, major players in the tech and energy sector can play a lead role in this once-in-a-century global transformation.

GLOSSARY

Additionality principle – The notion that carbon emissions reductions would not occur without the support from carbon credit sales.

Battery Energy Storage System (BESS) – Devices that use batteries to enable energy to be stored and then released as electric power when needed.

Clean energy – Energy derived from carbon-free energy technology sources. Examples include solar, wind, green hydrogen, geothermal or nuclear energy.

Colocation – A data centre in which equipment, space, and bandwidth are available for rental to customers.

Dispatchable technology – An electrical power system, such as a power plant, that can regulate its power output to the grid on demand.

Energy transition – The gradual shift of global energy use from fossil-based sources to a zero-carbon system through the move towards renewable energy sources like wind and solar.

Firming – Balancing output from variable intermittent power sources (e.g. wind/solar) for a specified period of time with dispatchable technology.

Grid carbon intensity – Measure of how much CO_2 emissions are produced per kilowatt hour of electricity consumed in a specific electric grid system.

Hyperscale Data Centre (HDC) – A class of data centres that carry 50+ megawatts (MW) of IT load. They tend to have onsite high voltage infrastructure built from the outset to enable this scale.

Long-Duration Energy Storage (LDES) – Storage through technology such as mechanical, thermal, electrochemical and chemical storage that can be deployed to store energy for prolonged periods to sustain electricity provision.

Power Purchase Agreement (PPA) – A long-term contract for the purchase of power between an electricity generator or supplier and a customer, usually a utility provider, government or company.

Volume matching – The achievement of 100% clean energy on a volume consumption average over a year.

About AirTrunk

AirTrunk is a hyperscale data centre specialist creating a platform for cloud, content and large enterprise customers across the APJ region. The company develops and operates data centre campuses with industry leading reliability, technology innovation and energy and water efficiency. AirTrunk's unique capabilities, designs and construction methodologies allow it to provide customers with a scalable and sustainable data centre solution at a significantly lower build and operating cost than the market.

A private company, AirTrunk is well capitalised to fund its development of data centres across the APJ region. In 2020, a consortium led by Macquarie Asia Infrastructure Fund 2 (MAIF2) and including Public Sector Pension Investment Board (PSP Investments), acquired a major stake in the business, investing alongside AirTrunk's Founder and CEO Robin Khuda. MAIF2 is managed by Macquarie Asset Management, one of the world's leading alternative asset managers and part of the ASX-listed Macquarie Group Limited (ASX:MQG).

For more information on AirTrunk, visit airtrunk.com

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