ASIANPOWER

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MANAGING DIRECTOR SHRI SATYAJIT GANGULY LAYS OUT NETC STRATEGIES TO KEEP THEIR MANDATE

HOW THAILAND FARES IN ITS QUEST FOR NETZERO

WHERE DOES BIOMASS ENERGY STAND IN ASIA'S POWER MIX?

3 TRENDS TRANSFORMING GAS INVESTMENT OPPORTUNITIES IN ASIA

HYDROGEN WILL OVERTAKE
NATURAL GAS IN APAC AS
GOVERNMENTS CHASE NET-ZERO





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The past decade has seen renewables as the future of power generation. In this issue, we take a close look at the Asia-Pacific region on its quest for net-zero emissions and a more sustainable future. APAC has seen a rapid decline in renewable costs, which brings forward competition between renewables and fossil fuels. And with the costs of producing green hydrogen set to drop by 75% by the end of the decade, APAC is ripe for a hydrogen revolution.

This issue highlights the different approaches that Asian countries take as more nations follow suit on China's

carbon neutrality pledge. Thailand has installed a renewable energy capacity of more than 15 GW. The Asian Development Bank in the Philippines has developed a scheme that can accelerate the green energy transition in Southeast Asia. See the full stories on page 6.

We have also sat down with the Managing Director of India's North East Transmission Company, Shri Satyajit Ganguly, to discuss the strategies that they have employed to keep a high power transmission availability across the North Eastern Region of India. See the interview on page 14.

Read on and enjoy!

7 CO **Tim Charlton**

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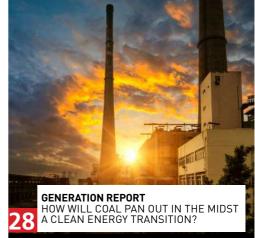




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FIRST

ADB SCHEME CAN ACCELERATE SEA GREEN ENERGY TRANSITION

PHILIPPINE



The Asian Development Bank (ADB) and Prudential's recently announced investment scheme to acquire existing Asian coal-fired power plants and retire them early could accelerate the transition to green energy of Southeast Asia, Fitch Solutions said.

Primary target markets of the initial phase of this scheme include Indonesia, the Philippines, and Vietnam

"From a recipient market point of view, even governments in traditionally coal-dependent markets like Indonesia and Vietnam have started to show an increased willingness to move away from coal in their recent energy strategies. From an international point of view, we have already seen an increase in green financing mechanisms, particularly from more developed nations and push for a 'green recovery' from the pandemic," it said in a report, adding that they are "cautiously optimistic" of its success.

However, its potential hinges on a few factors, such as parallel support for the build-up of alternative and reliable generation sources, being large enough to have a substantial impact on the entire power sector and presenting a more defined scope of which coal plant assets qualify for the scheme.

"The scheme will likely target newer coal power plants with decades more to its operational shelf life to achieve its objectives, and 'early closure' will still entail a 10-15 year timeline. In addition, there will still be some time lags before the scheme can be fine-tuned into an effective mechanism and expanded to the scale where it can significantly alter the power mix, especially given the fact that many of its target nations are emerging markets that are also actively trying to expand its power capacity to meet surging demand and support economic growth over the coming decade," Fitch added.

Amongst the schemes' financial partners are HSBC, BlackRock, and Citi. It is expected to be financed by a mix of equity, debt, and concessional finance, via public-private partnerships.

Currently, in its pilot, several details about the project have yet to be finalised. Prudential's preliminary estimates show that it would range from US\$1-1.8m/MW, which means that it would run into the billions at the minimum.

"There are also questions around the potential role of carbon credits, potential conflict of interest, moral hazards, and whether or not existing coal plant owners will embrace the scheme. These are expected to be finalised and announced at the United Nations Climate Change Conference (COP26) in November, with hopes for the first transaction in 2022," Fitch said.



How Thailand fares in its quest for net-zero

THAILAND

n increasing commitment to renewable energy has Thailand on course to become a sustainability success story within Southeast Asia – but it wasn't always this way. Kudun and Partners analyses how Thailand fared for the last few years. They noted that in 2010, 90% of Thailand's electricity supply came from coal and natural gas. By contrast, just 2% came from renewable sources.

According to an analysis report by Kudun and Partners Ltd., the Thai government introduced a series of initiatives starting 2007, which is aimed at increasing renewable energy production. Incentives were handled by the Electricity Generating Authority of Thailand (EGAT), which is committed to purchasing renewable energy from small producers within the country.

Further, the analysis pointed out that by 2014, there were other reasons to move toward renewable energy in Thailand. Natural gas production began decreasing that year due to waning supplies, forcing Thailand to re-think a large swathe of its energy mix. The country could make up for the shortfall, either by importing substitutes or by increasing its investment in domestically produced renewables.

Around the same time that Thailand's natural gas reserves began to prove insufficient for the country's energy needs, the Board of Investment published a highly insightful document that

Thailand's favourable natural and geographical features provided excellent means of renewable energy production

showed the way forward on this issue. The document noted that Thailand's unusually favourable natural and geographical features provided excellent means of renewable energy production in terms of "solar, wind, hydro-power, bio-energy (biomass, bio-gas, MSW), biofuels (ethanol, biodiesel, new alternative diesel fuel), and new energy sources (tidal, geothermal)."

Kudun and Partners' analysis report noted that the main focus of the plan is on solar and bio-energy because of the suitability and ease of production for these energy sources in Thailand. Its tropical location makes it an ideal place for the development of solar energy, as the country receives a large amount of solar radiation throughout the year. As for bio-energy, Thailand's economy is heavily based on agriculture, leading to the production of large amounts of agricultural and municipal waste that could be converted into usable energy.

With this, combined approaches to electricity generation have also proven to be successful. Kudun and Partners represented B. Grimm Power Public Company Limited and Energy China Engineering Group Shanxi Electric Power Engineering Co., Ltd. Consortium in their ongoing development of the world's largest hydro-floating solar hybrid power project located at Sirindhorn Dam and created with cooperation from the EGAT, the project is worth over THB842m (approximately US\$27m).

Thailand's move toward sustainable energy independence comes at a crucial time. The analysis report states that electricity demand in APAC is increasing at twice the global rate, putting it on track to double by 2040. Mindful of the increasing demand for power, yet determined to lower greenhouse gas emissions by 20.8% by 2030, the Thai government has expanded its system of incentives for green energy producers. Tax breaks, feed-in tariffs, easier access to financing, bidding programs, metering schemes, the Blockchain-based peer-topeer trading of electricity generated by solar energy, and a biomass-centred, community-centred power generation program called Energy for All are amongst the government initiatives aimed at boosting green energy production and use.

Meanwhile, renewable energy production in Thailand continues to increase. Over the past decade, wind power production experienced an average annual growth of 89%, and solar power production of 83%. Solar power is expected to grow by 10% each year until 2030, whilst wind power is unlikely to increase soon, says Kudun and Partners Ltd.





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FIRST

APAC: Is netzero possible?

ASIA PACIFIC

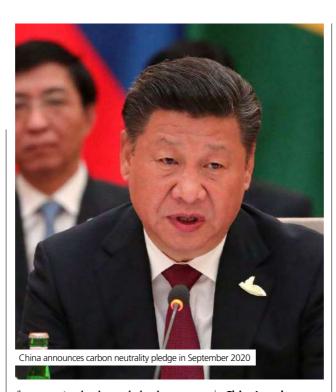
s discussions on Europe's route to net-zero progressed, China announced its carbon neutrality pledge in September 2020 followed shortly by Japan and South Korea, thus casting the net-zero spotlight on the Asia Pacific.

Wood Mackenzie's Analysts for APAC shed some analysis regarding the possibility of APAC reaching net zero. Principal analyst for Coal Market, Shirley Zhang, together with principal analyst for Gas and LNG Research, Lucy Cullen, shared their insights that as major global issues, such as emissions reduction, cannot be tackled single-handedly; strong performance of one country or region is not enough since net-zero goals actually carry different meanings and implications around the world. In the Asia Pacific, absolute carbon emission levels are currently about six times higher than that of the EU and the UK, and four times higher than the US. The scale of the challenge is obviously enormous in the Asia Pacific, dwarfing other regions.

The Asia Pacific has seen tremendous growth over the past two decades and many markets will continue to grow rapidly in the decades ahead. But this growth relies heavily on fossil fuel usage, particularly coal. 52% of the region's 2020 energy demand and over 70% of its emission footprint is coal-based, whilst Europe and the US rely more on oil and gas. Zhang and Cullen further said that electrification will be key to accelerating the transition to renewables, but rising power demand will prolong the Asia Pacific's fossil fuel dependence for the next decade at least.

Priorities will differ depending on government type, economic systems, geography, and self-sufficiency levels of resource and capital. The analysts pointed out that for emerging economies in South and Southeast Asia with robust economic growth, cheap reliable fuel is a critical prerequisite. The rapid decline in renewable costs continues to bring forward competition between renewables and fossil fuels, but intermittency issues remain. As a result, fossil fuels will stay dominant and emissions will continue rising in developing countries, unlikely to peak until the late 2040s. Nonetheless, their emission per capita levels will generally remain below developed economies.

At the same time, new coal financing is increasingly scarce. A key concern



for countries that have pledged net zero is if, and when, they can afford to phase out existing coal fleets without risking energy security, grid stability and rising retail power tariffs. All eyes are on Japan, which recently surprised the market with a more ambitious emission reduction target - a 46% cut by 2030 from 2013 levels. The country already bears the highest energy cost in this region with end-user tariffs double that of China and South Korea. Its aggressive plan to reduce both coal and LNG in the generation mix requires immediate action to boost controversial nuclear power from 6% today to 20-22% by 2030. In comparison, boosting renewables may be a more palatable alternative, but scalable long-duration storage must play an active role to allow higher penetration rates and ensure a stable supply.

As Wood Mackenzie's latest analysis of the Asia Pacific energy and emissions shows, countries across the region will make material progress towards net zero but even Paris Agreement goals, to limit average global temperature gains to 2 degree Celsius above pre-industrial levels (our Accelerated Energy Transition 2, or AET-2 scenario), remain elusive, given timescales and the hurdles ahead.

Powering the transition in the Asia Pacific is a unique challenge. Zhang and Cullen stated that significant policy and capital support will be called upon to build necessary supply chains, create future skills, and minimise social risks. This will require stakeholders across all countries and sectors to collaborate, adapt and reimagine existing energy systems.

China's carbon neutrality pledge, followed by Japan and South Korea, casts the net-zero spotlight on APAC



RENEWABLES CHEAPEST SOURCE OF ELECTRICITY IN 90% OF MARKETS

ASIA PACIFIC



Renewables are the cheapest source of electricity in 90% of the world's emerging markets as fossil fuel electricity generation peaked worldwide, a report by India's Council on Energy, Environment and Water, and Carbon Tracker found out.

"Given renewables are already the cheapest source of new electricity in 90% of the world, emerging markets (non-OECD countries plus Chile, Colombia, Mexico, and Costa Rica) have no need to build up huge electricity infrastructure based on fossil fuels," the report said.

It added that emerging markets have leapfrogged this stage and met the growing demand by deploying clean energy systems powered by wind and solar, with huge potential to boost economic development and bring electricity to millions of more people.

The study also said that emerging markets are key to the global energy transition, with 88% of the growth in electricity demand between 2019 and 2040 is expected to come from them.

"Emerging markets are about to generate all the growth in their electricity supply from renewables. The move will cut the costs of their fossil fuel imports, create jobs in domestic clean power industries, and save millions of lives lost to fossil fuel pollutants," Carbon Tracker's energy strategist Kingsmill Bond said.

This report is echoed by the International Renewable Energy Agency (IRENA), stating that, "Of the wind, solar and other renewables that came on stream in 2020, nearly two-thirds – 62% – were cheaper than the cheapest new fossil fuel."

According to IRENA, the decade 2010 to 2020 saw renewables becoming the default economic choice for power generation. The competitiveness of solar and offshore wind "joined onshore wind in the same range of costs as for new capacity fired by fossil fuels, calculated without financial support." This trend shows that not only are renewables competing with fossil fuels, but also significantly undercutting them, where new electricity generation capacity is concerned.

"Cheaper renewables give developed and developing countries a compelling reason to phase out coal while meeting growing energy demands, saving costs and adding jobs," IRENA added.



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ANALYSIS: GREEN HYDROGEN REPORT

Hydrogen will overtake natural gas in APAC as governments chase net zero

With the costs of producing green hydrogen set to drop by 75% by the end of the decade, APAC is ripe for a hydrogen revolution, argued UBS Analyst Peter Gastreich.



ow-carbon hydrogen is central to national net-zero targets globally, and the number of companies announcing hydrogen strategies has been growing. Hydrogen could play a much larger role in the energy mix than the 12% occupied by natural gas today (up to 400 million tons APAC hydrogen demand in the most aggressive scenario).

UBS Evidence Lab expected China to develop green hydrogen supply before other countries in the Asia Pacific region and to eventually build a 100% self-sufficient hydrogen economy. Japan and Korea are likely to rely on imports and may seek to lead global supply chain initiatives. Meanwhile, Australia and New Zealand could build surplus production and emerge as regional exporters. Markets in the EU and North America, on the other hand, will likely follow their own unique paths.

Hydrogen could reach an equivalent of as high as 15% of the current level of primary energy consumption in the long term. Using China as a test case, the estimated cost of producing green hydrogen will drop by around 75% by 2030 and by another 50% by 2050 and that the levelized cost of electricity (LCOE) will be the most critical element in the declining cost.

According to UBS Analyst Peter Gastreich, green hydrogen could begin to look attractive for use in heavy land transport and a carbon tax of c.US\$40/t could accelerate adoption in chemicals Green hydrogen could begin to look attractive for use in heavy land transport and a carbon tax of c.US\$40/t could accelerate adoption in low-carbon hydrogen industries



and steel—both large industries for low-carbon hydrogen in China—depending on transport distance.

Blue hydrogen will lose its cost competitiveness over green hydrogen by 2030, but this may not be the case in other global markets, such as North America.

Finally, the cost of transporting liquid hydrogen could remain prohibitively high in China, meaning that distributed green hydrogen production within 300-400 kilometres of end-user markets will likely be required, leaving central mass production of green hydrogen likely off the table.

APAC's addressable hydrogen market could reach 300 million tpa in the long-term, which is equal to around 15% of current primary energy consumption,



and about 9-10 times the current demand for hydrogen in APAC. For perspective, UBS said that natural gas currently occupies around 13% of primary energy consumption in APAC and oil occupies around 27%.

The 300 million ton demand outcome corresponds to UBS' "carbon abatement" scenario and is the most likely outcome in the long term for APAC. The "transformation" scenario would see demand reaching up to 400 million tons. Meanwhile, the "low penetration" and "slow boil" scenarios would see around 100 million tpa to 200 million tpa long-term hydrogen demand.

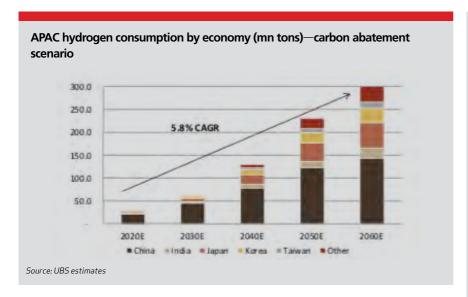
Today, the refining and chemicals industry accounts for nearly hydrogen demand in APAC. UBS anticipates that by 2050 to 2060, green and blue hydrogen consumed in transportation, power generation, and steel production in APAC will account for a respective 30%, 17%, and 20% of total APAC demand.

UBS also expected China will account for more than half of demand, and according to The China Hydrogen Alliance, hydrogen industry output value in China alone could hit US\$2t by 2050, still well below the potential estimated by 2060. A drop to below US\$2/kg in China would make green hydrogen competitive with diesel fuel for city buses, heavyduty trucks, and off-road vehicles, such as dump trucks for mining, particularly if the delivery point of hydrogen fuel is within 300 kilometres of the point of electrolyser production.

A decline the LCOE—the average net present cost of electricity generation for a generating plant over its lifetime—of renewable power is the primary factor that is anticipated to contribute to a decline in the cost of production of hydrogen in China. This is driven by our expectation that wind turbine and solar photovoltaic costs will continue to drop as cumulative renewable energy installation capacity continues to rise.

By the period 2020-2025), alkaline based electrolysers will be the mainstream solution for electrolysers used in China. This is primarily because Chinese-made alkaline electrolyser costs can be as low as one-third that of imported Proton Exchange Membrane (PEM)-based () electrolysers. However, PEM-based and western alkaline electrolyser costs are expected to decline sharply by 2025,

ANALYSIS: GREEN HYDROGEN REPORT



narrowing the cost advantage of Chinese alkaline electrolysers.

The costs of compressed hydrogen transport, which will likely be the mainstream solution for small-scale hydrogen transmission over the next decade, are seen to decline 25-30%. This would be driven by improvements in tube pressure levels. On the other hand, for large-scale onshore hydrogen transmission, pipelines could be the most economical solution. For end-users where a high hydrogen purity is not required (such as heating and power users), blending hydrogen into natural gas pipelines to as much as 15% could provide a viable alternative.

China aims to build a fully self-sufficient hydrogen economy—that is, not relying on imported raw material—and will be advantaged by capabilities in renewable energy for green hydrogen and geological carbon sinks for blue hydrogen. With China state-owned enterprises (SOEs) using their balance sheets to build out the supply chain, this could accelerate hydrogen development when compared to other markets. The China Hydrogen Alliance expected hydrogen to reach up to 20% of primary energy consumption in China by 2060. For perspective, this is close to what the oil industry currently occupies as a percentage of China's primary energy consumption.

Australia and New Zealand look to have advantages in domestic green and blue hydrogen supply, given the potential for deep penetration of renewable power generation to feed electrolysers and/or availability of geological carbon storage sinks. These could position both Australia and New Zealand as surplus producers or exporters of zero-emissions fuel.

The hydrogen economies in countries like Japan and Korea will likely be more import reliant, UBS believed. These countries will likely seek to build global supply chains to secure imports of hydrogen and ammonia (green and blue) in the long-

term. This could eventually have positive implications for growth in ammonia industries and have positive implications for seaborne trade volumes. However, logistical challenges still exist.

The United States national labs predict demand for hydrogen in the US at 1 to 14% of total energy demand by 2050 (equivalent to 22 million to 41 million metric tons annually), per the Department of Energy Hydrogen Program Plan. Currently, roughly 10 million metric tons of hydrogen is produced in the US, with over 90% from centralised reforming of natural gas (c.1% of total US energy consumption).

The European Union regards hydrogen as a key priority in achieving the European Green Deal and its clean energy transition. It understands the role that hydrogen can play in both storage of renewable energy and substitution of fossil fuels in carbon intensive processes as well as hard to eliminate parts of the transport system. The EU projects that hydrogen's share of Europe's energy mix will grow from <2% to 13-14% by 2050.

Generally, UBS believed that green hydrogen could be pushed at a faster rate in China than in the rest of the APAC region given that oil SOEs like Sinopec may be willing to accept lower returns for early adoption and in support of national net-zero strategies.

Our carbon abatement scenario in which hydrogen could represent around 15% of APAC energy consumption in current terms (300mn tpa), with China seeing the highest penetration rate and India potentially the lowest among the major economies. The China Hydrogen Alliance believed that the industry output value for China alone could reach around US\$2t per annum by 2050 and that is based on hydrogen reaching just 10% of primary energy consumption by that year (the Alliance expects up to 20% of primary energy consumption by 2060).

HYDROGEN REFRESHER



Hydrogen can be burned as a zero-emission fuel. Currently, nearly all hydrogen is produced from fossil fuels (coal and gas), but the industry is focused on developing blue hydrogen and green hydrogen.

- 1. Hydrogen classified as grey (produced from fossil fuels) could offset its carbon emissions with the adoption of carbon capture, utilisation, and storage (CCUS) to be classified as blue hydrogen.
- Green hydrogen is produced via electrolysers and powered by renewable energy, such as wind or solar.

As electrolyser costs fall, combined with further reductions in renewable electricity costs, green hydrogen will likely become less expensive than the estimated cost of blue hydrogen (i.e., hydrogen produced from fossil fuels with carbon abatement) in many regions. IRENA's latest 1.5°C scenario indicates a 12% hydrogen share of total final energy consumption by 2050, whilst the Hydrogen Council has suggested that an 18% share can be achieved by 2050.

Integrating hydrogen with offshore wind could be a means of carrying clean energy produced offshore to onshore via pipelines and bypassing the need to build an electricity transmission line. The possibility of storing hydrogen seasonally, similar to natural gas, can help utilise and manage the seasonal availability of excess renewable power.

Economies could capitalise on existing natural gas infrastructure for transportation and storage of hydrogen resulting in improved overall project returns. However, large-scale CCUS facilities will also be required to produce low-carbon hydrogen from natural gas. We note that grey hydrogen produced from natural gas via SMR could also be converted to blue hydrogen by capturing CO2. China may be the exception for blue hydrogen from the perspective that coal could play a more central role as opposed to natural gas.

Oracle Utilities leads modernisation of energy sector in Asia

It is focused on promoting the shift to smart meters and advanced metering infrastructures.



Recovery in the APAC region is projected to be uneven. The various COVID-19 lockdowns across the region have resulted in overall power demand reductions and increased home energy usage. Whilst there are signs of turnarounds in APAC, this will be mostly led by countries such as China but lesser in other countries.

Oracle Utilities' Nick Birrell, Vice President, Industry Strategy, Oracle Utilities JAPAC, said that the challenge facing the global energy sector is the so-called "3D's" of decarbonization, decentralized energy generation, and digitisation imperative.

"On the decarbonization front, the major northeast Asian economies of Japan, South Korea, and China have all recently pledged to transition to net-zero carbon by the second half of the century. Similarly, a large proportion of South East Asia and South Asian countries have also recently made net-zero commitments, along with individual Australian states and New Zealand," he said.

"This will further accelerate the trend of distributed energy, such as solar and wind. As increasing amounts of decentralized energy resources (DERs) are connected to the grid, we are observing increasing numbers of APAC utilities turning to digital technologies and smart grids to better manage the impact of all these newly installed DERs on the grid," he added

Birrell said that this digitisation trend will only accelerate as the need to better manage system flexibility, reduce peak loads, and improve grid reliability become even more acute.

This is complemented by the continuing market reforms observed across the region in the past year.

"For example, Vietnam's drive to open a competitive energy market, the reform of the Philippines spot market to five minutes, changes to wholesale market arrangements in China, and ongoing reforms to India's distribution companies and markets," he said.

With these developments, he said that investing in smart meters and advanced metering infrastructure (AMI) will enable utilities to transform and embrace new ways of doing business.

One example of this benefit is how AMI data disaggregation opens a wide range of benefits from driving demand-side response initiatives to opening new revenue streams by selling more efficient appliances to customers.

"AMI is an important contributor to grid reliability in the sense that voltage data from individual AMI meters are processed by the distribution management system (DMS) and can be used by grid operators to develop distribution system models and optimize voltages across the grid. Displaying voltage at each meter on a DMS SCADA diagram will help dispatchers instantly view and monitor network conditions at a glance," Birrell said.

"Smart meters will also be at the forefront of opening new energy business models, such as transactive and peer-to-peer models. With developments such as these, many more artificial intelligence and machine learning use cases will be imagined, especially when this data is combined with other data sources, including Internet of Things sensor data," he added.

According to Birrell, Oracle Utilities is committed to providing industry-leading solutions across the energy value chain. Corollary to that is they are equipped to navigate with highly secure, highly accessible,

and highly available cloud infrastructure to further the digitisation ambitions of utilities worldwide.

"The global smart meter market is not slowing down. According to Allied Market Research, the smart meter market is projected to grow at a compound growth rate of nearly 9% per annum over the next six years. The Asia Pacific region is expected to be the largest market, mainly due to China and India," he said.

"AMI will become a critical part of the larger arsenal that utilities, regulators, and governments alike must leverage to transition to a clean, sustainable, resilient grid. AMI is the prerequisite to achieving modern customer insights and operational efficiencies and improvements," he added.

Of course, modernisation is without its own challenges. Birrell said that another crucial factor is how customers will engage and embrace these new developments. As the industry moves to a more digital forefront, the need for engagement also increases.

"A challenge we often see is the failure to realise that an effective smart meter deployment is less an infrastructure project and more a customer engagement project. A large portion of the smart meter business case will be linked to customers acting on the data," he said.

"Therefore, utilities need to up their customer engagement game to ensure consumers understand the benefit to them and can act on it. Consequently, we see utilities increasingly investing in modern digital customer engagement platforms," he concluded.



Utilities need to up their customer engagement game to ensure consumers understand the benefit to them and can act on it



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CEO INTERVIEW

NETC ensures high transmission availability in NER, India

Managing Director Shri Satyajit Ganguly shares the strategies NETC employed to keep their mandate.

The North East Transmission Company Ltd (NETC) is the only transmission company providing operation and maintenance (O&M) in the North Eastern Region (NER) of India, and it achieved 99.95% transmission system availability for the financial year 2020-2021. According to its Annual Report 2020-2021, its transmission line availability is above the Central Electricity Regulatory Commission norm of 98.5% availability.

NETC is tasked to maintain the 662.8 kilometres (km) double circuit transmission corridor in the region and there were challenges, mostly environmental and terrain concerns, at this front. But various projects have been adopted to mitigate the effects of these challenges.

Asian Power caught up with NETC Managing Director Shri Satyajit Ganguly about the strategies, projects, and future plans of the company.

How did you start at NETC Ltd.? Please share with us your work experience.

I was appointed as the managing director of ONGC Tripura Power Company Ltd. with additional responsibility as managing director of NETC Ltd. in the year 2018; and from the year 2020 onwards, I was appointed as full-time managing director in NETC Ltd.

I have 35 years of experience in the power sector encompassing generation, transmission, power exchange, power market, policy and regulatory advocacy, strategy and business development across central government, public sector and private sector in some of the best companies of India.

What are your key achievements as the CEO of NETC Ltd.?

For operation and maintenance, we ensured 99.95% availability for the FY20-21 of NETC Transmission System by ensuring preventive maintenance in line with the schedule, backed up with prompt corrective maintenance despite the difficult terrain. We have also proactively ensured perfect coordination with POWERGRID, Pioneer Construction, Telegence Powercomm Pvt. Ltd., as well as state transmission utilities to ensure planning and implementation of maintenance protocol to ensure maximum possible availability of power despite lockdown constraints. We also facilitated the optimisation of all existing and sustainable transmission technology.

For the strategic aspect, we ensured continuous evaluation, improvement, and implementation of standard operating process and standard maintenance practices, and created a business development plan to explore project management consultancy (PMC) in transmission in NER and consultancy in related areas.

What's the most important project you have spearheaded for the company?

North East Transmission Company is entrusted with the maintenance of its 662.8-km, 400-kilovolt Double Circuit transmission corridor through similar difficult hilly and dense forest terrain of the States of Tripura, Meghalaya, and Assam in the NER. Some of the forest terrains are also inhabited by wild animals, mainly elephants and leopards. The transmission line crosses two major rivers, namely: Brahmaputra and Barak.

NETC
coordinates
with power
distribution
companies
and state
transmission
utilities
to ensure
maximum
possible power
availability
despite
lockdown
constraints





The challenges include the vulnerability of line due to exposure of tower foundations because of landslides and rains, submergence of towers in low-lying areas, and tower endangerment during high wind and cyclones and changing course of rivers, amongst others.

In order to mitigate these challenges, various measures have been adopted, which include temporary and permanent wall protection, stub encasement and additional anti-rust painting of tower legs in waterlogged areas, and adoption of pile foundations for towers under threat due to the river changing its course.

Other mitigating measures include the adoption of chemical earthing along with the provision of Transmission Line Arrestors in high isokeraunic level coupled with high soil resistivity, clearance of vegetation at frequent intervals, and developing environmental awareness amongst local people, and replacement of disc insulators with polymer insulators and painting of towers with zinc-rich, anti-corrosive paint in a polluted area.

What's in store for NETC Ltd. in the coming years?

NETC is poised to grow in the areas of PMC in the transmission sector in NER states, signature analysis of power and distribution transformers in NER states, and supervisory and advisory support for smart metering projects in NER. NETC is also venturing in the renewable energy sector—solar, wind, and solar-wind hybrid starting with micro or mini projects for NER. Furthermore, methodologies and modalities to be adopted shall be put up. We are also planning to participate in national and international PMC, engineering, procurement, and construction projects along with other equity partners.

Knowledge in Power

Whether global or local, events that change the way we live and work only intensify the demand for reliable electricity. And they amplify issues like financing and regulation that make the path toward sustainable, resilient grids challenging. In these times of uncertainty and rapid change, we're investing in you with forward-looking educational webinars on the latest trends, technical resources and best practices across power generation, transmission and distribution.

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Hydrogen Market
Overview



Hot Topics When Considering Solar PV and Battery Energy Storage Projects



Renewable Integration into the Transmission Systems



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CEO INTERVIEW

Asia expected to consume more than half of the world's energy

However, Asia's Energy Revolution author noted that net-zero goals are still in progress.

Toseph Jacobelli has published a new book titled Asia's Energy Revolution. He sat down with *Asian Power*'s Managing Director Tim Charlton to talk through the changes taking place as the region slowly wakes up to net-zero.

Where is Asia right now in its power transition?

The region is likely to annually spend at least \$1t through 2050 in its energy transition.

Right now, Asia consumes almost 50% of the global energy consumption. What that number does not tell us is that 11% of that is from developed Asia, so 89% is from emerging Asia. A lot of these emerging economies are incredibly sizable like China, India, and Indonesia. China is going to at least grow its consumption threefold, if not more, by 2050. Then there are some emerging markets like Sri Lanka, where consumption may rise as much as 20-fold. The region will aggressively add clean energy sources and gradually shift its energy mix away from fossil fuel-based generation. The elephant in the room is, of course, China.

China right now has about 1,080 gigawatts of coal power generation. The planners have said that it is going to peak at 1,100 gigawatts in 2025. So there's an extra 20 gigawatts, but it is a net number. They are actually building newer plants and closing down older or smaller ones. The big question is with nuclear because they will need some very chunky amounts of generation in order to offset the coal generation plants likely to close down. China had about 50 gigawatts of nuclear energy at the end of 2020 and targets 75 gigawatts by 2025. The big question is whether the amount will be 300 or 500 gigawatts by 2050. China has been concerned about nuclear safety so they are not going to put up gigawatts of nuclear energy if they are not 100% comfortable with the safety of the technology.

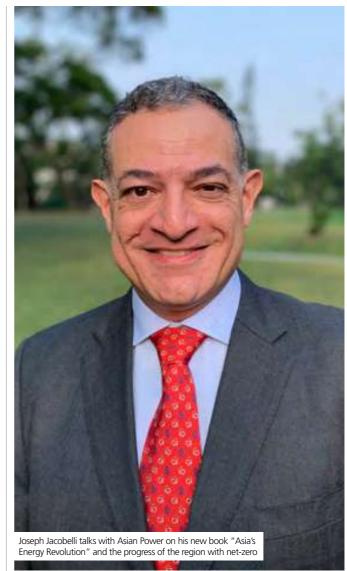
For coal, now there is a bigger global pressure, which is net-zero emissions by 2050. So countries are very aggressively exploring green alternatives—and that's not limited to solar and wind. We know that some countries, such as Thailand and Vietnam, have been very successful when it comes to introducing more green and sustainable power. I expect a substantial rise in the region in offshore and floating wind, more decentralised solar systems, and more energy storage.

At a bare minimum, you have got to go low carbon. Then Southeast Asia will have to really come up with a more credible blueprint as to what it wants.

In your book, you talked about the dramatic rise of electric vehicles. How will this impact the consumption of power? Indeed, in the book, I discussed one key upside factor to consumption growth, electric mobility, and one limiting factor, energy efficiency. I argued that the upside factor is highly likely whilst the limiting factor is unlikely to be effectively implemented region-wide. On e-mobility, one example of an "upside" move is Singapore. All vehicles, like buses, taxis, etc., will be clean energy vehicles by 2040. It means that the rate of electrification in the transport industry in places like Singapore is also going to go through the roof, and that is being replicated in other places like China. Japan is a little bit slow off the mark in terms of hard targets, but there are

Coal and gas industries are humongous for the economy in Australia, but the states and the private sector have successfully driven the energy transition





countries like Thailand, Sri Lanka, and even Pakistan, with electric vehicle (EV) targets. So we will see a lot more goals-setting and the numbers of battery-powered electric vehicle numbers going through the roof. All this progress means that more generations will be needed.

Let us talk about specific markets and, perhaps, start with Australia, which is the most advanced along its energy market deregulation journey.

Some, especially the politicians, say that Australia has had unsuccessful deregulation, but I actually disagree because the Australian consumer now has a choice. Whether residential, commercial, or industrial, today, users shop around for the best price. Also, the quality of service has vastly improved.

The issue, however, has been one with the federal government because the coal and the gas industries are humongous for the economy down in Australia; so, there has been this distortion.

Nevertheless, states and the private sector have successfully driven the energy transition. For example, there are 15 gigawatts of rooftop solar as we speak today, so it is absolutely amazing. There are also massive clean energy projects being planned. These include the Asian Renewable Energy Hub, which will take ten years and cost about A\$36b (\$25.2b). It will involve building massive wind and solar facilities of about 26 gigawatts in the East Pilbara region of Western Australia. Another is the 10 gigawatts Sun Cable project, called the Australian–ASEAN Power Link, which will take about seven years and cost about A\$22b (\$15.4b) to develop.

CEO INTERVIEW

Now, let us look at Hong Kong. What is happening there?

I live in Hong Kong and the two major utilities here are CLP Power Hong Kong and Hongkong Electric. They have been shifting their energy mix towards gas, slowly but surely, and that is going to continue. The companies operate on a rate-based return, which means that the companies are allowed a return on investments from the net assets, under long term contracts with the government. The two Schemes of Control Agreements will expire in 2033. The big question is if these will be extended or not? Currently, the two companies have a virtual monopoly over generation and supply. So, will that be broken and what happens to stranded assets?

For Hong Kong to use more green electricity, it can import more nuclear energy from Mainland China and it can also import solar or wind power. So the first thing that needs to be addressed is the fate of these contractual agreements between the utilities and the government post-2033. Then, the other big question is whether Hong Kong is going to 100% adopt the Chinese energy policy, which, so far, it has not. Meaning adopting a deregulated power market and prioritising clean energy resources.

On the mainland, generators can sell directly to commercial and industrial users, just like in Singapore or in Australia. They are just not allowed to do so with residential or the agriculture sectors yet. That is one piece of deregulation that you have in Mainland China that you do not have in the Special Administrative Region. The second piece is clean energy. China is the undisputed global clean energy leader in terms of how much it has built, in how it manages its capacity in terms of its planning. For example, there are offshore wind farms near Hong Kong but they are not selling power to Hong Kong, they are selling power back into Mainland China. The country had 570.5 gigawatts in solar and wind capacity at the end of August; and in the first eight months of 2021, it added 36.7 gigawatts.

Let us talk about how you see the green financing revolution.

I will split that into two concepts. One is plain vanilla financing. For example, at the end of the day, green bonds are just bonds. Now you've got a whole new generation of bonds, including sustainability-linked bonds, where a company will issue a bond and if it meets XYZ target, by whatever year, they will pay a slightly lower coupon rate. If they do not match it, they will pay a slightly higher coupon rate. I expect the Asian credit market to boom in the coming years. I recently estimated the amount of such bonds issuance could potentially reach \$350b in 2025 from \$53b in 2020.

On the public equity side, we haven't seen a massive amount of

Potential Power Generation Multiple Growth in Developing Asia 2050 versus 2018 (x). Developing Asia Total Bangladesh Pakistan Sri Lanka Philippines Indonesia Vietnam Scenario 1: Japan as base; no population growth Thailand Scenario 2: Japan as base; populations grow China Scenario 3: Average as base; no population growth Scenario 4: Average as base; populations grow Malaysia 5.0 10.0 15.0 25.0 ■ Scenario 3 ■ Scenario 2 ■ Scenario 1 ■ Scenario 4 Author, June 2020. Estimates background data from: Global Change Data Lab (n.d.). World Population Growth. [online] Our World in Data. Available at: https://ourworldindata.org/search?q=world+population+growth [Accessed 6 June 2020]. BP

(2017). Statistical Review of World Energy | Home | BP. [online] BP Global. Available at: https://www.bp.com/en/global/ corporate/energy-economics/statistical-review-of-world-energy.html [Accessed 6 June 2020].

Global Energy and Power Output Share in 2019. Global Power Generation Share Global Primary Energy Share

Source: bp p.l.c. (2020). Statistical Review of World Energy. [online] BP Global. Available at: https://www.bp.com/en/ global/corporate/energy-economics/statistical-review-of-world-energy. html [Accessed 4 September 2020].

Status of Electric Power Market Reform in Key Asian **Economies**

	Reform	Reform Plans	No Clear Plans
Australia	1		
Bagladesh			100
Cambodia			4
China	1		
Hong Kong S.A.R.			- A
India	1		
Indonesia		1	
Japan	1		
Laos			- W
Malaysia		1	
Mongolia			of i
Myanmar			7
New Zealand	1		
Papua New Guinea			- As
Singapore	1		
South Korea		1	
Taiwan (China)		1	
Thailand		1	
Vietnam		1	

green and sustainable companies listing in the region. I think what is going to happen is that the green portfolios of companies, such as some of the big electric power groups in the region, will list in stock markets over the next few years.

On the lending side, Asian banks have been slow in adopting net-zero emissions targets, whereas, in Europe, a whole bunch of banks have said that by 2050 they will have a net-zero emissions portfolio. It also means lending to green and sustainable companies is going to be significantly higher.

We have seen some moves out of the Singaporean banks like DBS and OCBC to cut loans to coal-fired projects and we have seen Chinese banks being aggressive in looking at setting net-zero targets. However, other banks have been a little bit slow. So, I think the second trend that we should see over the next five years or so is a lot more Asian banks declaring their net-zero emissions targets. That is going to help a lot with the funding of green and sustainable projects in the region.

One final point is that there is an enormous amount of capital in the private equity markets right now in Asia looking for green and sustainable projects. Apart from private equity funds, we are also witnessing more green and sustainable investments from corporations, and, not just from electric power or other energy companies but also from companies in other sectors. Examples of this are small green and sustainable energy projects by the Hong Kong real-estate firm, Swire Properties, both in Hong Kong and in China.

ANALYSIS 2: SOLAR WASTE

India faces solar waste crisis as recycling is not economic

India needs to catch up with other countries in managing and financing renewable plant recycling, argues IEEFA consultant Saloni Sachdeva Michael.



India has already crossed 100 gigawatts (GW) of installed renewable energy capacity and is on its way to increase that four-fold to 450 GW by 2030. As of July 2021, the nation has 44GW of solar and 40GW of wind installed capacity. Whilst this is great news for helping the country reduce its fossil fuel consumption, it is creating a huge amount of plant waste that will have to be dealt with in the future in a country that is not set up to recycle.

The estimated recycling cost is currently US\$20 to US\$30 per solar panel as compared to US\$1 or US\$2 to send it to landfill. This is not just a problem only in India. In 2019, the world generated a striking 54 million tonnes of e-waste, an average of 7.3 kilograms per capita. The global generation of e-waste has grown by 9 million tonnes since 2014 and is projected to grow to 75 million tonnes by 2030.

The global generation of e-waste has grown by 9m tonnes since 2014 and is projected to grow to 75m tonnes by 2030



However, in most countries, there are already laws in place to deal with solar panel recycling, but in India, there are currently few. India's photovoltaic (PV) waste is estimated to grow to 200,000 tonnes by 2030 and to around 1.8 million tonnes by 2050.

The circular economy is attracting the attention of global financiers. The last 18 months have witnessed a steep increase in the creation of debt and equity instruments related to the circular economy. Whilst no such fund existed in 2017, 10 public equity funds focusing partially or entirely on the circular economy have been launched by leading providers including BlackRock, Credit Suisse, and Goldman Sachs. India is yet to see specific financing activity linked to renewable plant recycling, however, the Reserve Bank of India recently echoed the need for such disclosures.

Fourth largest

By 2050, India will be the fourth-largest solar panel market in the world and burying panels once they end their life is not a good option. The International Energy Agency's Photovoltaics Power Systems Programme recently released research on the safety of disposing of PV panels in landfills. The main pollutants of concern for each of the major PV modules to be crushed are lead for crystalline silicon panels; cadmium for cadmium telluride or CdTe panels; and selenium for copper indium gallium selenide or CIGS panels.

As much as 90% of a module's glass and 95% of the semiconductor material can be recovered during recycling. Aluminium frames can be recycled and processed into usable raw material for furniture, cell phones, or new solar panel frames.

The silicon cells can be recycled as raw material for new solar cells non-silicon PV modules, such as thin-film modules, basically need to undergo chemical treatment to separate the various semiconductor materials, allowing as much as 95% recovery of the materials. Total estimated costs, including transportation, can vary between US\$400 and US\$600 per tonne, far exceeding the value of the recovered material.

India is piloting some initiatives. The SWAP project, (Solar Waste Action Plan), is looking to investigate both the technical and economic feasibility of a PV module recycling system with support from the Signify Foundation and the Doen Foundation. A holistic approach whilst implementing the Atmanirbhar Bharat (self-reliant India) scheme could be the game changer. Instead of reinventing the wheel every 10 or 15 years, a structured recycling industry should be established. Another innovative concept worth exploring is waste trading. The byproduct or waste of one industry could be the raw material for another industry. As renewables grow in India the government will be forced to deal with the recycling issue.

HOW SOLAR PANEL RECYCLING IS DONE INTERNATIONALLY

Penalty approach—The EU Waste of Electrical and Electronic Equipment (WEEE) directive requires PV producers and suppliers to finance the costs of collecting and recycling PV panels or face large fines.

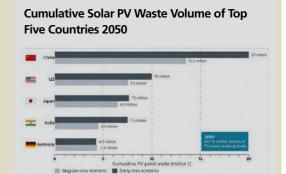
Centralised management—The WEEELABEX organisation in the Czech Republic is responsible for the preparation of standards and the awarding of certification for collection, storage, processing, and reprocessing of e-waste, as well as the monitoring of waste-processing companies.

Annual monitoring and reporting—The Italian National Institute for Environmental Protection and Research issues annual reports to the Ministry of

the Environment, Land, and Sea Protection about the quantities and categories of electrical and electronic equipment located on the market, prepared for reuse, recycled, and recovered.

Government support—South Korea has been supporting initiatives for PV waste recycling. In 2017, the Ministry of Trade, Industry, and Energy planned a facility to recycle PV module waste in North Chungcheong province.

Private sector participation—A U.S.-based solar panel manufacturing company, First Solar, has established factories in the United States, Germany, and Malaysia. The company uses recycling methods with recovery rates of 95% for Cd and 90%







COUNTRY REPORT: VIETNAM

Rooftop solar power a 'huge potential' for Vietnam's clean energy goals

This is given Vietnam's expansive network of industrial parks and the appetite for clean energy.

If there there are countries whose energy sectors have powered through the obstacles brought by the pandemic, one worthy of mention is Vietnam.

In 2020, the size of Vietnam's power system expanded by 23% to 69 gigawatts (GW), the fastest annual growth registered. More importantly, most of the additional capacity came from solar power. The country had just welcomed the first wave of investment in solar power with astonishing results.

Institute for Energy Economics and Financial Analysis (IEEFA) Energy Finance Analyst Thu Vu noted that with the government's successful response to COVID-19 throughout 2020, renewable energy investors managed to push Vietnam further into the energy transition pathway.

"In less than two years, non-hydro renewable penetration reached 25% of the system, and is on track to deepen further as a significant number of wind power projects are due to come online later this year," Vu said.

As demand starts to pick up in 2021,



Thu Vu

Vietnam is seeing the initial signs of a structural transition as solar power plants become more integrated into the system, replacing fossil fuel-based sources, such as gas or expensive oil-fired power.

In the first half of the year, renewables accounted for 11% of the generation mix, up from less than 5% last year.

At the same time, the rapid emergence of commercial and industrial rooftop solar power is a trend worth noting especially this year.

"Amidst the delayed issuance of the next round of feed-in-tariff policy for rooftop solar, developers have been focused on rooftop solar installations with solutions that would maximise on-site consumption by commercial and industrial users," Vu said.

Such occurrence is an area of huge potential for Vietnam given its expansive network of industrial parks and the appetite for clean energy from global brands and their suppliers to Vietnam's export markets.

"This is a win-win solution for all stakeholders and one that is here to stay," the analyst said. Meanwhile, Vu observed that the party which has been facing the most challenges adjusting is the state-owned utility company Electricity of Vietnam (EVN).

"On one hand, there's the pressure to integrate this new variable renewable energy source into the system, through necessary grid upgrades and dispatch decisions affecting other generation sources such as coal or gas. On the other hand, demand growth has plummeted by 3.4% in 2020 versus the pre-pandemic 10%, and the government froze electricity tariffs, forcing EVN to manage the generation mix and cost profile very carefully," she said.

Most generation sources have felt the impact, with a lower utilisation rate of the coal and gas power fleet and curtailment risk materialising for solar power plants.

Looking into Vietnam's PDP8

Meanwhile, delays in the power planning process have been the biggest challenge for Vietnam this year.

The current status of the Power Master Development Plan 8 (PDP8), which will determine the role and room for growth



COUNTRY REPORT: VIETNAM



of each generation source until 2030, is still the topmost concern to the power generation industry now.

"Whilst it is understandable that policy-makers are cautious and have taken extra time to refine the Power Master Development Plan 8 given the long-term impact of the strategy, the timely issuance of the plan is much needed to help instate market order and confidence. Investors in LNG and offshore wind power are impatiently waiting at the door and there is not enough room inside for everybody," Vu said.

She added that work needs to begin on these large scale projects if Vietnam wants to avoid an energy crunch in the foreseeable future.

For IEEFA Director of Energy Finance Studies for Asia Melissa Brown, the PDP8 delay can be an opportunity for Vietnam's policymakers to reset and improve market structures.

"The past 12 months have been a period of intense activity for Vietnam's power sector. The planning process surrounding PDP8 has dominated headlines as project sponsors scoured the country to confirm business partners, project sites, and potential allies in advance of a sign off that was expected at the end of March," Brown said.

She added that the intensity of the lobbying process is a fair reflection of the scale of the business opportunities and the expectation that PDP8 will set Vietnam's power development program for the next 20 years.

"Vietnam remains to be Southeast Asia's most attractive energy growth market, with 68GW of new capacity expected to be added to the system between now and 2030 under a base case scenario," Brown said.

In a report, Brown outlined the three

basic steps that the Ministry of Industry and Trade (MOIT) can take that would put the PDP8 process on a stronger footing and improve the government's ability to win the right terms from developers. She emphasised that the key is to foster, rather than eliminate, competition between renewable and fossil fuel players.

This can be done by increasing the efficiency of existing generation assets with targeted grid investments, by reducing the pressure to lock in potentially uncompetitive projects, prioritising critical investments in the grid that will increase the efficiency of the existing generation fleet, and increasing the output from strategically positioned new renewable assets.

"This effort would help stabilise the grid and support the push for more favourable contract terms in the future. The key to this is more coordinated policy implementation from MOIT that can open the door to supportive funding strategies from the multilateral development banks that will accommodate diverse sources of power PDP8 is expected to set Vietnam's power development program for the next 20 years



and storage," Brown said.

At the same time, MOIT should commit to an early round of auctions for renewables bundled with storage to encourage competition and reduce curtailment risk.

"The rapid build-out of renewable capacity over the past two years has positioned Vietnam to now benefit from significantly improved pricing from experienced incumbent players, provided that storage investments are encouraged as a means of offsetting curtailment risk," the director said.

Lastly, Brown noted that it is now time for MOIT to feel confident that investment in the Vietnamese power market does not require generous guarantees that rob the market of dispatch flexibility.

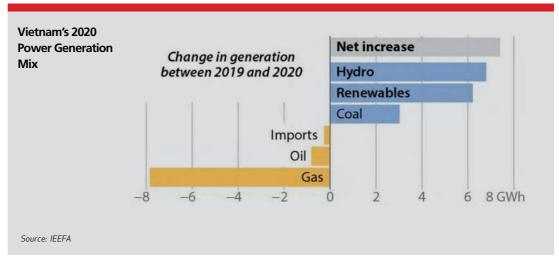
"The positive experience with renewables makes it clear that the demand for guaranteed take-or-pay fuel contracts and power offtake agreements from some LNG developers is nothing more than a negotiating gambit," she said.

Meanwhile, a report from Fitch Solutions highlights that Vietnam's PDP8 will set higher targets for gas and other renewables in the domestic energy mix for the decade ahead.

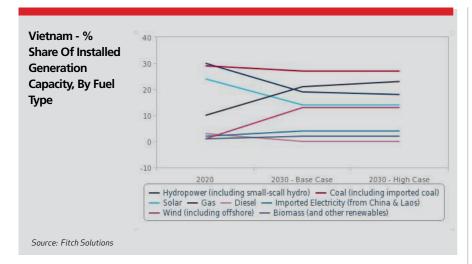
They noted that the plan affirms in writing Vietnam's nascent support for the clean energy transition, and outlines the ambition to increase the share of cleaner-burning gas in the national power generation capacity composition to 21% by 2030, under the base-case scenario, from about 10% in 2020.

"In order to achieve these targets, Vietnam is aiming to reduce contributions from domestically-produced coal (albeit coal imports look set to remain elevated) and hydropower (with developments shifting in favour of small-scale hydro) which, despite the lower cost and stable supply, contribute to air pollution and cause environmental damages," Fitch Solutions said.

PDP8 estimates that about US\$96b



COUNTRY REPORT: VIETNAM



would need to go towards the development of power sources such as LNG, solar, and wind to make the targets feasible. About US\$56b worth of LNG related investments, or 23 different LNG-to-power projects, have been proposed and announced in Vietnam.

The think tank noted that the bulk of the current pipeline is backed up by financial, developmental commitments from US-based companies, although only a handful have secured formal approval and even fewer have signed power purchase agreements with stateowned EVN, the sole permitted buyer of electricity in Vietnam.

"Continuing to attract more up-front investments and strategic investors will be crucial in order for Vietnam's LNG sector to live up to its full potential, which based on current projections could prove considerable. Though the main risk is the fact that Hanoi has no history of importing LNG," Fitch Solutions said.

They added that multiple elements including policies, regulations and legal frameworks, such as those associated with ensuring market competition, the role of SOEs, local gas pricing mechanism, domestic power market liberalisation and technical standards for LNG-related infrastructure amongst others, remain in the dark.

In the report, Fitch Solutions has also observed the growing need for LNG in Vietnam. Hypothetical LNG imports are forecast to see exponential growth from less than 1bcm to over 4bcm over the next decade, next to a more than doubling of domestic gas demand and growing utilisation across power generation and industries.

"The current forecast for LNG is conservative and assumes both the Ca Voi Xanh (peak 10bcm) and Block B (peak 5bcm) to come through as planned within the forecast period. However, import volumes could very well surpass current projections should these upstream ventures struggle to

come online or the pace of fuel-switching across industries exceeds current expectations in part due to slower growth in other renewables segments," they said.

Improvement over losses

Meanwhile, Vu's earlier report on EVN also highlighted how the state utility came through 2020 in surprisingly good financial health, posting an improvement in its operating margins and gross profit despite the delays and challenges brought by the pandemic.

"Faced with constrained revenue growth caused by slowing demand, lost revenue from tariff rebate programs, and a government-mandated tariff freeze, the improved profitability reflects EVN's ability to optimize the system and keep operating costs in check," Vu said.

The report showed that in 2020, favourable hydrological conditions in the monsoon season enabled EVN to work with a higher mix of low-cost hydropower which went up 10.2% versus the previous year and accounted for 30% of the generation mix.

At the same time, increased dispatch of

Continuing to attract more investments and strategic investors will be crucial for the full potential of Vietnam's LNG sector



solar power also led to lower utilisation of gas power plants (-18.4%) and costly oil-fired power stations (-44.0%). Coal power output rose slightly (+2.5%) and remained the dominant source, responsible for half of the generation mix.

"EVN's improved financial position is due to a cost-friendly generation mix thanks to the better availability of inexpensive hydropower, rather than a sustained strategic fix," Vu added.

However, Vu noted that the one red flag in the 2020 results is that EVN held back on capital spending. This means that the much-needed investment in grid infrastructure may continue to be a problem, particularly for the renewable energy assets, which is now facing curtailment risks.

"EVN's grid upgrading efforts continue to be scrutinized by incumbent renewable energy investors and will remain crucial to the sector's future growth," she stated.

Still in headwinds

Looking into 2021, the analyst described that the ongoing fourth wave of COVID-19 and the severe mobility restrictions that have been implemented have caused havoc for the large pipeline of wind power projects now chasing the October 31st feed-in tariff deadline.

"For the remainder of 2021, we are likely going to see heated debates and discussions about the level of support that the government might extend to these projects. The sooner that gets settled the better," Vu said.

She added that she expects the final PDP8 and subsequent regulations to stir up intense price competition between different technologies in the coming years, due to the unprecedented diversity of investors and technology that are being attracted by Vietnam's power market.





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GENERATION REPORT: GAS



Future of gas power sector 'in the dark' over energy transition

LNG might be the sector's main driver for demand growth.

he demand for oil and gas will boost, especially come the second half of this year, as the global rollout of COVID-19 vaccines will help the global economy rebound—and this will be paralleled by the global energy consumption. Industry leaders in the Asia Pacific have then presumed that oil and gas demand will post modest gains in 2021 especially during H2.

Asia Pacific's oil and gas industry, however, can be seen facing a new normal, beyond the unprecedented challenges brought about by the pandemic and into uncertainty amidst the ongoing energy transition of many countries to a more environment-friendly and less carbon-intensive energy mix.

Fitch Solutions noted that the cyclical recovery, which started late in 2020, has continued to accelerate, particularly as more countries make significant progress with vaccinations and continue to ease some restrictions.

"Given the accelerating pace of vaccination in key markets, a strong relationship has been established between lower ongoing COVID-19 impacts and a robust return in fuel consumption," Fitch Solutions said.

The rapid collapse in refined fuel demand due to COVID-19 laid bare the precarious position of low-margin petrochemical refiners



It mentioned, however, that a cautionary note should be highlighted in areas in which lockdowns were reinstituted after a spike in infections for second or third waves did see fuel consumption fall.

Meanwhile, the think tank also observed that the rapid collapse in refined fuels demand from COVID-19 laid bare the precarious position of low-margin refiners.

"Although all refiners have suffered from low margins and reduced output in the face of surging fuel supplies, we expect newer facilities that support high-end premium products and petrochemicals to rebound stronger during the recovery," it said.

Fitch Solutions views that refinery closures continue to mount as fuel demand remains well below pre-COVID-19 levels. A lack of international air travel and local lockdown measures continue to see fuel market overcapacity build as new facilities come online in the near term.

The return in fuel demand post-COVID has not been enough to preserve downstream facilities facing challenging market conditions. Fitch Solutions noted that whilst this trend had already been in play prior to 2021, the pandemic impacts have accelerated the pace of closures.

"The sharp downturn in fuel demand across 2020 has yet to fully return in most markets with some developed markets forecast to have already peaked. This disconnect between existing capacity and new build capacity that can better compete on cost and quality has seen further announcement of facility closures globally," it said.

Environmental impacts to accelerate strategy shift for the oil and gas industry Fitch Solutions noted, as of the time of its writing, that there have been at least 934,000 b/d (43%) of refining capacity announcing either closure or conversion to biofuels in the Asia Pacific region.

Moreover, external pressures from environment-related impacts and a quickening approach of peak oil demand brought on by the low-carbon energy transition will accelerate a strategy shift for the oil and gas industry, with a more diverse set of companies announcing netzero ambitions and investment plans to reduce climate impacts.

"The impacts of the events are yet

GENERATION REPORT: GAS

Natural gas prices, 2015-2021 40 35 30 25 20 15 10 0 5-Jan-15 5-Jan-21 Oil Parity NEA Spot LNG (\$/mmbtu) Japan LT (\$/mmbtu) NBP (spot) (\$/mmbtu) SWE Spot LNG (\$/mmbtu) HH (spot) (\$/mmbtu) Source: GECF

The complex **LNG** investment environment and buyers' appetite for lowcarbon LNG are key challenges faced by the LNG industry



to be fully realised, but it is clear that shareholder and regulatory pressures continue to build for substantial reductions in emissions. In our view, this will accelerate the trend already in play and force oil companies to either reduce output further or to divert more capital investment into decarbonisation efforts to curb emissions. Ultimately, these efforts will lead to a long-term decline in production," Fitch Solutions said.

LNG to drive demand growth

The Gas Exporting Countries Forum (GECF) observed that the massive lockdowns and multiple various disruptions across the world brought about by COVID-19 severely impacted liquefied natural gas (LNG) trade. However, it grew to its record number by the end of the year, mostly driven by Asia Pacific's steady demand and underlying global economic recovery.

Expanded exports from Australia and the US contributed to the supply side of the equation. In essence, LNG trade has proven resilient, increasingly diverse, and global, according to the GECF.

They added that due to this, LNG might be the last great opportunity in the oil and gas industry. LNG trade has been historically showing remarkable development over the past two decades with over 3.5 times growth, ramping up from 103 million tonnes (mt) in 2000 to 356 mt by the end of 2020.

GECF Energy Economics Analyst Galia Fazeliyanova observed that though the overall LNG market was much more robust compared with the oil market through the course of the pandemic, there was a significantly increased volatility in traded volumes and extreme turbulence in spot prices.

"The structure of the LNG trade was evolving over the past few decades and

2020 just amplified that transformation. There is a clear and consistent trend towards gaining higher flexibility, agility, current and forward-looking liquidity of the LNG markets," Fazeliyanova said.

She added that the complex LNG investment environment and buyers' appetite for low-carbon LNG are amongst the key challenges to be faced by the LNG industry in the future.

Although being at initially low levels on average through 2019, the natural gas spot market witnessed plummeting prices, resulting from downfallen demand in the first half of 2020 due to the pandemic, as well as the warmer than expected 2019-2020 winter in the northern hemisphere.

However, Fazeliyanova observed that it all turned around as natural gas spot prices increased 18-fold from lows seen just six months ago. On top of post-COVID recovery, a general rebound in prices was explained by market fundamentals, as well as temporary dynamics, primarily driven by the supply side: colder-than-normal winter, LNG supply disruptions, and limited shipping capacity.

"Natural gas spot price volatility has affected a broad array of industry stakeholders. It impacted the short-term targets of the suppliers and portfolio players to optimise their trading strategies in 2020. LNG suppliers and buyers were reconsidering old and signing new longterm agreements at lower levels of oil indexation, between 10% and 11% record low levels, compared to the earlier 14% slope contracts," the analyst said.

At the same time, she mentioned that LNG buyers are increasingly considering LNG's low-carbon properties on top of price competitiveness. The market witnessed a spike in carbon-neutral LNG deals in late 2020 and early 2021 as increasing pressure coming from the government's changing policies and tighter regulations.

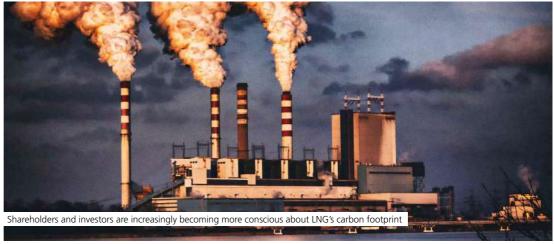
"The corporate sector's shareholders and investors are increasingly becoming more conscious about LNG's carbon footprint. Asian buyers' interest in 'green' LNG continued to ramp up last year, crystallising a new sustainable trend of future LNG trading," she said.

No smooth sailing

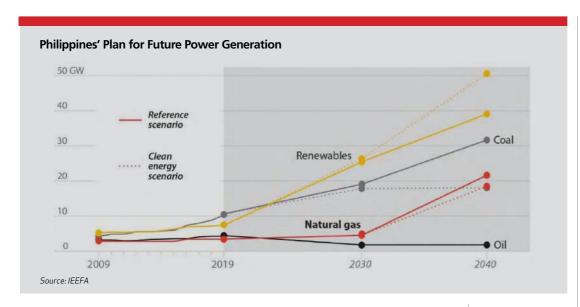
The International Energy Agency expects emerging LNG importers in the region to be the main drivers of global demand growth behind China and India, raising suppliers' hopes for a tighter global market and higher prices.

Institute for Energy Economics and Financial Analysis (IEEFA) Energy Finance Analyst Sam Reynolds observed that many Southeast Asian countries, including the Philippines, have subscribed to the industry-driven narrative that natural gas presents a viable transition fuel from coal-fired generation capacity to a clean energy future.

Burdened with the highest electricity prices for residential consumers in the region, a high exposure to volatile global coal prices, and increasingly severe natural disasters caused by climate change, Reynolds noted that the Philippine government has signalled its



GENERATION REPORT: GAS



commitment to transition from coal-fired power.

With the expected depletion of the Malampaya deepwater natural gas development—the country's only domestic source of natural gas—officials have endorsed a rapid buildout of LNG import infrastructure.

"The race to develop LNG facilities in the Philippines has gone from a marathon to a sprint. Malampaya is nearing depletion sometime in the mid-2020s, meaning existing gas-fired power plants will need to find a replacement fuel source in the near-to-medium term," Reynolds said.

However, the country's long history of incomplete LNG import projects raises the question of what changes have been done recently to overcome regulatory and financial hurdles that beset conventional projects in the past.

Reynolds observed that to date, a large diversity of industry players with extensive financial capacity and project management expertise have been unable to bring LNG-to-power assets online.

"Policymakers have tried increasingly to iron out lower-level administrative hurdles and incentivise investment by issuing permitting rules, publishing investor guides, and proposing legislation to govern the midstream and downstream natural gas sectors ... Yet the higher level legal and regulatory regimes for LNG are still in their nascent stages and could take years to refine and implement, adding uncertainty to the future market environment."

He added that for the midstream natural gas industry, characterised by low profit margins and long payback periods for high-cost infrastructure, stability is crucial to minimising market risks. "Such high uncertainty in the Philippines market contradicts the nature of the industry, especially with almost no existing infrastructure in place," he said.

Looking into the 'gas-fired recovery' of Australia's economy

The Australian government launched the country's so-called "gas-fired recovery" in September 2020, suggesting that gas was the "critical enabler of Australia's economy."

However, IEEFA Gas Analyst Bruce Robertson stressed that the government may be relying on inaccurate financial assumptions for its gas-fired recovery as most gas- and coal-fired power plants in Australia are being operated less and less – what is more known as a declining capacity factor.

A declining capacity factor poses serious risks to investors in fossil fuelled power plants if they have relied on financial modelling, which anticipates power plants having a constant capacity factor throughout their lifetime, meaning they expect a plant to produce electricity at a constant level, every year, until the end of its life.

"Similar to the downward trend in coal, the capacity factor of gas-fired power plants is also forecast to decline. Yet financial modellers are still basing Similar to the downward trend in coal, the capacity factor of gas-fired power plants is also forecast to decline



their calculations on the assumption power plants are producing 'constant' power over their lifetime. This leads to an underestimation of the cost for each unit of electricity to be produced over the power plant's lifetime – what is called levelized cost of energy," Robertson said.

He added that cost underestimation can cause a financial overvaluation of the energy asset, which is then likely to mislead investors.

"If the Australian government is relying on a constant rather than the more realistic declining capacity factor over the lifetime of a new gas-fired power plants' life, they are hoping for an unrealistically low cost figure for generating electricity from that plant, and they are, perhaps mistakenly, misleading potential backers as to the real value of the asset," the analyst said.

IEEFA further noted that for the protection of all investors, the assumption of a constant capacity factor should be revised in order to avoid financial overvaluation of fossil-based energy assets.

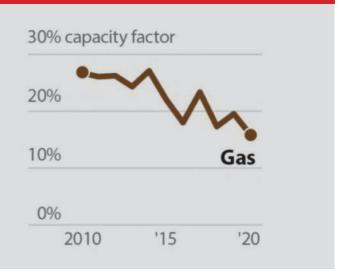
"This poses an even greater risk when massive government investment enters the market in the form of subsidies such as through the Australian government's spending on a gas-fired recovery," Robertson said.

The government intervention will likely mislead investors, bankers, and asset managers into directing financial flows towards similar gas-fired energy assets into the future, and will likely ignite negative financial consequences for investors.

"We argue that the Australian government through its 'gas-fired recovery' is fundingand encouraging investment in assets which are financially overvalued and likely tobe stranded before they have even been built," the analyst said.

Decline in capacity factors for Australian gas power plants over 10 years

Source: IEEFA





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GENERATION REPORT: COAL

How will coal pan out in the midst of a clean energy transition?

There are still planned coal plants in the Asia Pacific despite carbon neutrality pledges.

sian countries are still forging ahead with plans for new coal plants and that could be a problem for investors as political pressure grows for countries to achieve net-zero. Whilst much of the developed world has essentially banned new coal power plants, 80% of new coal power plant capacity is expected to come from just five countries in Asia, namely: China, India, Vietnam, Indonesia, and Japan.

This could be a colossal economic mistake, said at least one non-government organisation, Carbon Tracker, which estimated that 92% of planned coal units are expected to be uneconomic, even under business as usual, with up to \$150b estimated to be wasted. This also means that achieving net-zero emissions would prove to be more challenging, especially in the Asia Pacific.

Not surprisingly, Carbon Tracker reckons investments in new renewables beat investments in new coal in all major markets when comparing the levelized cost of energy (LCOE) for both.

Carbon Tracker said that the cost competitiveness of renewables versus the

New renewables beat 77% of operating coal, which will rise to 98% by 2026 and 99% by 2030



global coal operating fleet is growing. Currently, new renewables beat 77% of operating coal, and this will rise to 98% by 2026 and 99% by 2030 based on current pollution regulations and climate policies when comparing the LCOE of new renewables to the long-run marginal cost of existing coal units.

"The report finds around 70% of the global fleet relies to some degree on policy support and would likely be unprofitable in the absence of market distortions. Coal is increasingly unviable both financially and environmentally and is ceasing to make sense as an option for investors and governments," Carbon Tracker stated.

The pandemic bore witness to the decline in coal generation amidst the rise in renewables, despite forecasts of rebound due to increasing energy consumption. However, in Asia, the story was one of continued coal consumption with coal use up 1.2 %, according to the International Energy Agency (IEA).

Vietnam, in its latest draft of the Power Development Plan, still plans on building new coal plants; whilst China, in its 14th five-year plan, referenced promoting the "clean and efficient" use of coal underpinned by its large project pipeline.

Contradicting earlier pledges

China has pledged in September 2020 to achieve net-zero emissions by 2060. This has set China to be a key player in the world's decarbonisation goal, as it is currently one of the countries with the largest amount of carbon footprints.

China is planning to build 43 new coal-fired power plants and 18 new blast furnaces—equivalent to adding about 1.5% to its current annual emissions—according to a new report.

These were announced despite their pledge to bring emissions to a peak before 2030, and become carbon neutral by 2060.

In its most recent global energy outlook, the IEA has predicted 2021 to have the largest increase in energy-related carbon emissions since 2010, driven by a rebound in the use of coal in Asia, with demand expected to grow 4.6% and coming close to the 2014 peak.

Much of the increase is down to a revival of coal being used for electricity generation in China.



GENERATION REPORT: COAL

Keeping old coal plants open

Meanwhile, Australia is planning to keep old coal plants open in its ambition to lower electrical power. The government is proposing that electricity consumers pay to keep old coal plants running indefinitely, even if they are grossly inefficient—in what is called a capacity payment.

The critics, however, have mentioned that this latest plan by the Australian government is anomalous with the government's ongoing efforts for years to get prices down in the electricity market.

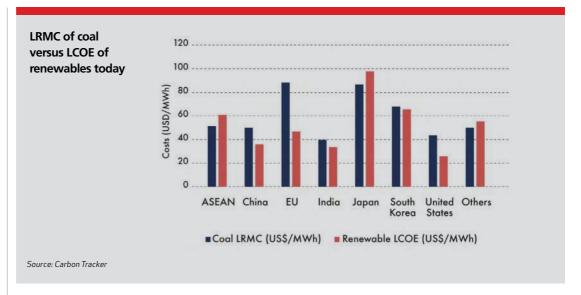
"The Australian government has long been worried that electricity prices are too high, and has gone through enormous contortions at the generation end to change that," said Owen Evans, Financial Analyst for the Institute for Energy Economics and Financial Analysis (IEEFA).

He added that the Federal government can better achieve its ambition to lower electricity prices if it focuses on the transmission and distribution side of the energy market, instead of the generation side.

"The generation side has enough renewable capacity to meet any supply gap from inevitable coal plant exits for the next 10 years. Putting even more subsidies into the generation side of electricity will further distort markets which inevitably will cost consumers more," the analyst said.

"Transmission and distribution is the largest single cost in a consumer's electricity bill at around 50% and it is the area where the government has the greatest power," he added.

IEEFA has calculated that households are likely to see increases in their electricity bills of between \$182 to \$430 a year to keep the ageing coal plants running, more than double the carbon price.



Owens emphasised that the latest "coalkeeper" strategy to keep old coal plants operating even if they're not efficient is another waste of money, with electricity prices for consumers set to soar, not drop. "The capacity payment is not a long term solution to lowering electricity prices for consumers," he said.

Moreover, IEEFA's Energy Finance Analyst Sam Reynolds said coal prices have been volatile because of the "stopstart nature" of the pandemic on global economies.

"The stop-start nature of COVID-19 lockdowns has resulted in prices falling and then rising sharply especially for major market India. China's demand and its buying of non-Australian coal have upset trade flows and added to price volatility," Reynolds told *Asian Power*.

He also said that coal producers are hesitant to invest in new capacity because more banks and financial institutions issue policies that stop coal-related financing at a future date.

Some governments, communities, and investors are also taking steps

The stopstart nature of COVID-19 lockdowns has resulted in coal prices falling and then rising sharply



against coal projects. In the Philippines, the government issued policies that are supporting renewable energy and stopping or only allowing legacy coal plants to be built. Due to this, investors and local governments are expressing opposition to coal and other related projects, Reynolds noted.

Whilst the pandemic exposed the volatility of coal prices, Reynolds said the coal sector is "painfully adopting" as coal companies look at renewable wind power projects, as well as coal downstream and carbon capture for coal plants.

But the cost of carbon capture facilities and the uncompetitive costs of coal downstream projects indicate that the said projects are facing problems financially, he said, adding that coal miners are experiencing difficulty in refinancing debt and it is "very likely to continue."

Dominating the thermal coal production in APAC

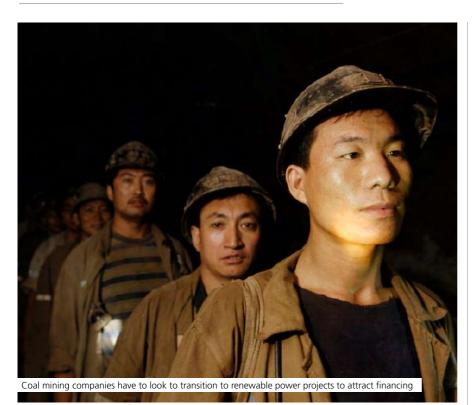
Fitch Solutions forecasted that Australia and Indonesia will continue to produce the bulk of total thermal coal output in the Asia Pacific region at approximately 85% to 90%. These countries will also continue to account for approximately 12% of global coal production in the coming decade.

They noted that concerning Australia, the coal industry will experience limited production growth over the long term, as prices stabilise and environmental regulations heighten along with increasing competition from lower-cost foreign producers.

"Coal production growth in Australia will average 0.05% year-on-year (YoY) during 2021 to 2030, with output increasing minimally from 297 million tons (mnt) in 2021 to 298mnt in 2030. As investors become wary of climate change issues and global energy consumption patterns shift away from coal, established



GENERATION REPORT: COAL



Coal will remain a key fuel of choice for Asian countries over the coming decade as coal supply remains abundant and cheaper in the market



players will increasingly leave the highcost Australian coal market, while smaller players enter," they said.

Environmental issues and protectionism will also continue to pressurise Australia's coal sector in the coming years.

Although the Queensland government has approved Adani Group's Carmichael coal, rail, and port projects, the group has had to fund 100% of the project, as announced in November 2018. Several banks refused to bankroll the expansion due to intense lobbying by environmental activists. Australia is expected to be at risk of a sudden tightening of environmental regulations, placing in limbo numerous new coal mining projects in the pipeline.

On the other hand, Indonesia will remain the largest coal producer in absolute terms in Southeast Asia at least in the coming decade, although production growth will slow in the coming years.

Fitch Solutions forecasted coal production growth in Indonesia to average 0.48 % YoY from 2021 to 2030, with output increasing from 468mnt in 2021 to 487mnt in 2030.

"Coal will remain a key fuel of choice for Indonesia's power expansion and a key generation source over the coming decade as coal supply remains abundant and cheaper in the market, alongside a government commitment for the source particularly to protect its coal mining industry," they said.

They added that the relatively low cost of the feedstock means that coal will remain the fuel of choice to meet surging power demand in the country.

The government aims to boost domestic coal demand and support coal prices, as they expect lower demand internationally when more markets move towards cleaner generation sources.

The think tank also noted that coal power generation accounted for approximately 60.7% of Indonesia's power mix in 2020, and this figure should rise to 65.0% by 2030.

Production steadily rising

Meanwhile, Vietnam's coal mining sector is expected to outperform in the coming decade in comparison with other countries in Southeast Asia.

Coal production growth in Vietnam will average 1.02% YoY from 2021 to 2030, with output increasing from 39mnt in 2021 to 42mnt in 2030. The resource industry in Vietnam is largely state-led and

heavily regulated by the government. Stateowned miner Vinacomin is the largest coal producer in the country at present, accounting for 95% of domestic coal production and has a production capacity of around 40 to 45mntpa.

"Official forecasts put coal consumption at 100mntpa by 2030. Nevertheless, the mining sector will continue to be dampened by decreasing coal prices in the long term, higher natural resources tax, which was implemented since July 2016, as well as higher production costs due to the depletion of coal layers, which are easier to access," Fitch Solutions noted.

There are also two proposed coal downstream projects in Indonesia involving US-listed company, Air Products; the first is a coal-to-methanol project that will be built in East Kalimantan in partnership with Bakrie Capital Group, Reynolds said.

Air Products said that it will invest about US\$2b for the coal-to-methanol project. The facility will enable the production of nearly 2m tons per year (TPY) from about 6m TPY of coal. It is expected to be onstream in 2024.

The other project, meanwhile, is a coal-to-Dimethyl Ether project plant that will be built in Sumatra in partnership with Indonesian state coal miner PT Bukit Asam Tbk, he said.

Moving forward, Reynolds said coal mining and power plants in Asia are going to face a "smaller pool of capital" to refinance their debt.

"Coal mining companies are likely not to aggressively expand their output due to the shrinking capital that is available to them. Coal mining companies have to look to transition to renewable power projects to attract financing," Reynolds said.

"The high-cost structure of coal downstream and carbon capture will most likely mean that such projects are unlikely to proceed due to the financial risks," the analyst concluded.



Source: Fitch Solutions



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ANALYSIS 3: BIOMASS

Where does biomass energy stand in Asia's power mix?

It will likely grow, but not as rapidly as solar power.



Biomass, for its dispatchability, edges out sources of renewable energy, such as wind and solar. It also proved to be viable in some parts of Asia, yet reports show that biomass may not grow as rapidly as solar energy had in recent years.

According to The Stimson Center, biomass is already a viable source of energy in Asia, particularly in Japan and Koreawith both states importing biofuel for their biomass production. Additionally, small-scale projects have also emerged in other Asian states, such as Thailand, Malaysia, and Vietnam.

Despite this, Courtney Weatherby, Deputy Director and Research Analyst of The Stimson Center, said biomass, as a renewable energy source, might not rise in the same way solar power had grown over the years.

"It is unlikely to rise as rapidly as solar has in recent years to become a major part of the electricity supply given significant challenges with supply chain, efficiency concerns compared to other power sources, and cost competitiveness.

"There are some efforts aimed at utilising on-site biomass electricity production as part of a closed loop cycle for individual industries, small-scale farms, and as part of a process of managing urban waste. These efforts have benefits beyond energy production that might attract further policy attention and investment, but are generally viewed through more than just a lens of energy or electricity production," Weatherby told

Biomass is unlikely to rise as rapidly as solar has in recent years to become a major part of the electricity supply given significant challenges



Asian Power.

Traditional biomass, Weatherby said, served as the primary energy source of some 45 million people who had no access to electricity in Southeast Asia. It also met 10% of the energy demand in the region in 2018 whilst, modern biomass and biogas provided around 3% of the power demand in 2019.

"This is likely to grow—in particular due to the classification of biomass as renewable and a potential path forward for meeting SDGs (Sustainable Development Goals) and Paris Agreement commitments," Weatherby said.

Biomass plays a major role economically, especially in countries largely reliant on biomass for household use; but its impact compared to other power sources still vary on key factors.

"The extent to which it can help boost economies compared to alternative energy sources, such as fossil fuel or other renewable energy sources, will depend on its economic competitiveness and a range of factors including land pressures, environmental impacts and concerns," Weatherby said.

The downsides to biomass

Whilst biomass can easily be dispatched compared to other renewable energy sources, using it has downsides, such as challenges in the supply chain, land-use competition, deforestation, as well as air pollution and emission concerns.

Biomass, as an additional energy

source, is viable in countries with existing dependence on agricultural productivity. However, it could potentially encounter issues in the supply chain.

Moreover, biomass plants could lead to environmental concerns, particularly in cases when power plants have limited scrubbing. This may produce more carbon and pollutants than power plants that rely on captured methane from waste landfills or burn agricultural waste.

It uses plant-based products that can be farmed; but this does not necessarily equate to biomass being a clean source of energy.

"Biomass is renewable, but whether it can be counted as clean is situationally dependent," she said, adding that its use has raised questions as it posed risks similar to that of fossil fuels amongst other concerns.

"Whilst the environmental impacts depend on the fuel source and the type of technologies used to process biomass, the potentially substantial environmental impacts mean it's difficult to broadly classify biomass as sustainable," she said.

Biomass energy produces air pollution and emissions as by-products just as other fossil fuels do. Weatherby noted that the key difference of biomass against fossil fuels is its efficiency and availability.

"The key policy-relevant differences between the two lies in efficiency—biomass is generally less efficient than fossil fuels per unit of electricity—and availability—biomass is renewable, whereas fossil fuels are not," she said.

On top of this, cost is another factor in considering biomass as an additional energy source. Biomass cost varies by fuel type and based on the local market conditions, such as the availability of low-cost feedstocks.

When feedstocks, like waste of byproducts from agricultural production are available, the cost of biomass can be competitive. However, Weatherby noted this is not the case in many places.

Citing the International Renewable Energy Agency, the levelised cost of modern bioenergy dropped to US\$0.066 per kilowatt hour (kWh) in 2019 from US\$0.076/kWh in 2010. It later rose back to US\$0.076/kWh in 2020.

"Prices in major markets of India and China were lower. This puts the cost of biomass on par with many new fossil fuel and hydropower projects in Southeast Asia, but makes it more expensive than new solar projects in many locations," she said.

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LEE MATHER

3 Trends transforming gas investment opportunities in Asia



Lee MatherVice President and Director,
Black & Veatch

Tations across Southeast Asia are seeking to expand their gas infrastructure to support the increased share of renewable energy in their generation mix.

In Vietnam, a 3,000-megawatt (MW) liquified natural gas (LNG)-to-power complex is expected to be constructed in the province of Long An. According to its draft 8th Power Development Plan, Vietnam plans to increase gas thermal power in its energy mix from 13 percent currently to 24% by 2045. The draft covers the period 2021-2030, with a vision to 2045.

In the Philippines, a long-term electricity supply contract for 1,200 MW has been awarded to an LNG-based power project. The country, which aspires to develop an LNG hub, has approved the permits of five proposed LNG Regasification Terminal projects that will operate from 2022-2025.

In Thailand, a 1,400 MW natural gas-fired combine cycle turbine facility is expected to be built west of Bangkok. The feasibility of developing a five million tons per year floating storage re-gasification unit (FSRU) in the Gulf of Thailand is being studied.

According to the Black & Veatch Strategic Directions: Electric Industry Asia 2021 report, two-thirds of the region's electric industry participants believe natural gas has a future beyond 2035 as a significant component of the grid.

The question is how gas infrastructure will play a role and what that means for the region's power and LNG industries.

Three trends are reshaping how we consider and plan for the long-term use of gas infrastructure in Asia.

Black & Veatch foresees investment in gas infrastructure as critical in both de-risking power generation portfolios and achieving an affordable transition to a decarbonized and stable power supply in Asia.

Flexible and fast grid stabiliser

As utilities replace reliable, dispatchable generation assets with intermittent power sources, Asia's lower-carbon energy systems will need highly flexible, dispatchable generation to maintain grid reliability and resiliency.

Today's advanced gas turbines in a simple cycle configuration can supply more than 400 MW to the grid in 10 minutes and are designed to reach full combined cycle load in 30 minutes to one hour. New gas turbine technologies can now operate at very low loads of less than 25% of their baseload capacity in some cases and ramp at 10-15% of their full load capacity per minute.

Asia's utility leaders will need to map out future operational scenarios and consider efficiency trade-offs.

Similarly, looking beyond baseload heat rate and designing to maintain low heat rates across a broad operating range would enable greater gas turbine flexibility and its evolved role in future energy systems.

As grids demand more flexibility from large combined cycle plants, plant startup profiles become more crucial and initial design should incorporate appropriate measures to allow fast start and higher load ramping capabilities. Additionally, Asian markets will start the shift towards load correction plants. Gas engine-based plants or smaller gas turbine-based plants will make a comeback in near future.

Opportunity: Considering its cost, flexibility, and emissions profile, with the right planning, gas turbine generation has a place in Asia's fuel mix for years to come as a high efficiency, reliable baseload source, and by serving as a complement to systems with wind and solar generation.

Bridge to decarbonisation and replacing with hydrogen

Gas turbine assets are likely to have significant commercial value beyond 2035, or even 2050, operating in a future net-zero world.

Futureproofing starts by designing in the flexibility to operate across services ranging from energy storage to baseload generation whilst also considering revenue opportunities in ancillary and grid reliability services. In addition, whilst considering the emergence of cost-effective carbon capture utilisation and storage technologies, another future pathway leads to gas turbines' role in accelerating the use of clean-burning hydrogen generation – in part or full.

Today's most advanced gas turbines can utilize 30%-50% hydrogen fuel content. Each of the major gas turbine manufacturers are making substantial progress on a path to supporting 100% hydrogen fuel within this decade. It is also expected that the manufacturers will design upgraded technologies that can be retrofitted into these machines.

Opportunity: Thinking of turbines operating with hydrogen can reshape investment prospects for power developers. With minimal initial investments, utilities and investors can plan and design for conversion to 100% hydrogen or other future scenarios that increase their returns over prolonged lifecycles beyond typical 30 years of service.

LNG-to-power and LNG-to-ammonia

One major challenge facing Asia's gas-fired generation facilities concerns supply; most gas fields are not located near high-demand electricity centres and often separated by seas. LNG has served as the medium-for-transport supplying gas to many locations throughout Asia.

The case for integrated regasification and power generation is compelling, whether fully integrated or partial. For example, for a combined cycle facility with a nominal output of 700 MW and a net present value of US\$200m over 15 years, it is estimated that integrating a nearshore floating regasification unit as part of the combined cycle facility could earn an additional US\$300m given gains expected in power output and efficiency. Such benefits should be considered by investors in Southeast Asia where gas-fired generation sites near coastal waters are plentiful.

In addition, building both a gas-fired power plant and LNG regasification terminal opens further commercial opportunities to potentially market LNG to regional enterprises through a hub-and-spoke concept. This may accelerate as industrial customers seek to switch from diesel to less carbon-intensive gas.

Looking over a longer investment period, there is a potential synergy between LNG and ammonia infrastructure, given the adaptability of LNG infrastructure and ability to convert for use with ammonia.

Ammonia is gaining attention as a stable energy carrier for hydrogen whose volumetric energy density makes storage and transport technically and economically challenging. Ammonia is more energy-dense than liquid hydrogen and is also easily liquified for storage and shipment.

Opportunity: All these scenarios call for reconsidering gas investment more holistically and considering risks across power generation, LNG receiving terminals and regasification infrastructure. Rewards are evident for understanding and planning around the full value chain alongside likely future market shifts.

Conclusion

Maximising these operational advantages will require thinking ahead in the early project development stages. Gas turbine investments are set to yield significant returns for investor for many years in Asia. However, the industry will need to consider the functionality of gas infrastructure in new ways, plan for and anticipate change, and build in greater levels of adaptability to future market conditions as the world drives toward a decarbonised and sustainable future.



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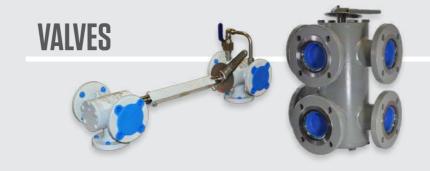


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