



Egypt seals LNG and hydrogen deal with Germany

The governments of Egypt and Germany have agreed to strengthen bilateral LNG trade and build a green hydrogen sector in the Middle Eastern country. The two memoranda, signed just before the start of the COP27 Climate Summit, signal Berlin's readiness to support Egypt in switching from fossil to climate-friendly energy and provide short-term help to diversify German gas imports.

Cashing in on Europe's gas crisis, Egypt boosted LNG exports from its two main liquefaction plants – Idku and Damietta – by 7.2 million tons to reach \$8 billion in gas export revenues in fiscal 2021/22, up from just \$0.6 billion in fiscal 2013/14. Gas exports sweep about \$500 million per months into Egypt's state coffers and finance minister Mohamed Maait said the aim is to "raise that figure to \$1 billion in the coming period."

German is hard-pressed to secure firm alternative gas supplies sources as deliveries from Russia's Gazprom were reduced and ground to a complete halt in September. The German chancellor Olaf Scholz hence visited several resource-rich countries across Africa and the Middle East in recent months – with limited success so far.



Tanker loading at Damietta LNG

ADNOC warns West not to shun fossil fuels

Arab upstream companies are concerned about the West's pledge to end support for fossil fuels abroad by the end of 2022. Sultan al-Jaber, CEO of Abu Dhabi National Oil Co. (ADNOC) said "zeroing out" on hydrocarbon investment would lead to a loss of millions of

continued on page 2

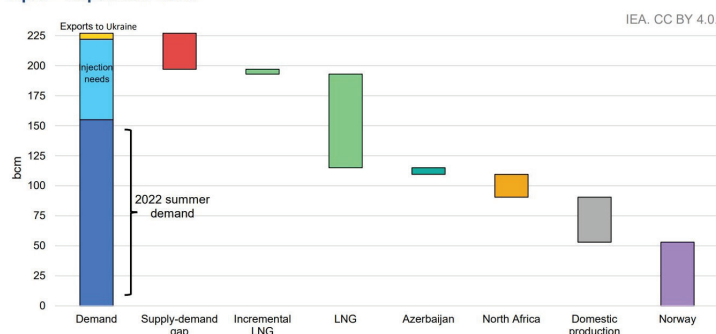
IEA warns Europe could face 30 Bcm gas supply gap next summer

Though gas storages in the EU are now 95% full, the International Energy Agency (IEA) warns Europe could face a gap of 30 Bcm in the 2023 summer refill season. Russian deliveries are likely to stay cut off and if China's LNG imports recover to 2021-levels, they would capture over 85% of the anticipated rise in global LNG supply.

In 2023, global LNG supply is expected to rise by "only 20 Bcm," with about one-third of the growth coming from the United States. "The expected rise in global LNG supply next year is about half the average increase during the 2016-2019 period and much less than the likely decline in Russian pipeline deliveries (80 Bcm) to the EU next year," analysts commented.

This summer, the process of filling EU gas storages benefitted from the fact that Russian pipeline deliveries were close to "normal" levels for much of the first half of the year – before Gazprom halted flows over a row on sanctions and payment terms. Russia delivered around 60 Bcm of pipeline gas to the EU in

Breakdown of the summer 2023 natural gas balance of the European Union and the United Kingdom in case of full cessation of Russian flows and limited LNG availability, April – September 2023



2022, but the IEA cautions this is "highly unlikely" to be repeated in 2023 when Russia could rather halt supplies completely. Moreover, Chinese buyers diverted substantial volumes of LNG to Europe as Beijing's strict no-Covid policy and regional lock-

continued on page 2

AGENDA

DEMAND

Spain's gas-burn soars in October due to price cap 2

SUPPLY

Wholesale power prices in New England could jump 60% this winter 3

Eight CCGTs with over 7.7 GW capacity get added in the US this year 3

EMISSIONS

Falling demand for fossil fuels makes emissions peak in 2025, IEA finds 4

TECHNOLOGY

Certarus supplies H2 and blending gear to A.J. Mihm power plant 5

PROJECTS

Tokyo Gas, Marubeni set up JV for LNG-to-Power project in Vietnam 7

Continued from page 1, top story

barrels of oil per day – vastly more than this year's supply shock.

"Now is not the time to point out that the longer term underinvestment in oil and gas has made a difficult situation even worse," Jaber said just days before the COP27 Climate Summit started in Egypt this Monday, referencing the energy supply chain shocks following the Russian invasion of Ukraine.

Russia has been by far the world's largest exporter of fossil fuels, but a reorientation of global energy trade in the wake of the Ukraine war, is leaving it with a much-diminished position. Russia's share of internationally traded energy, which stood at close to 20% in 2021, is forecast to fall to 13% in 2030 the IEA's Stated Policies Scenario, while the shares of both the United States and the Middle East rise.

Reacting to the supply gap, the UAE has been quick to increase its production capacity for oil and gas, as well as refining. But the emirate is also venturing into clean energy: "It is not oil, or gas, or solar, or wind, or nuclear or hydrogen," Jaber said. "It is all of the above."

Looking for leeway to finance gas projects

Striving to secure alternative supplies to Russian gas, Germany and Italy want to weaken the pledge to stop export finance for oil and gas projects.

Defying criticism, the governments in

Berlin and Rome want to keep supporting new gas extraction projects abroad though this would be incompatible with their pledge at the COP26 in Glasgow. At the time, 39 countries and institutions committed to end any support for fossil fuels flowing abroad by the end of 2022.

Trying to find a leeway, a German official suggested state funding could go towards gas transport infrastructure – instead of upstream activities, though support for these was not categorically ruled out. During a visit to Senegal, Chancellor Olaf Scholz indicated Germany could support the gas extractions, power generation and LNG production projects in the west African country. ■

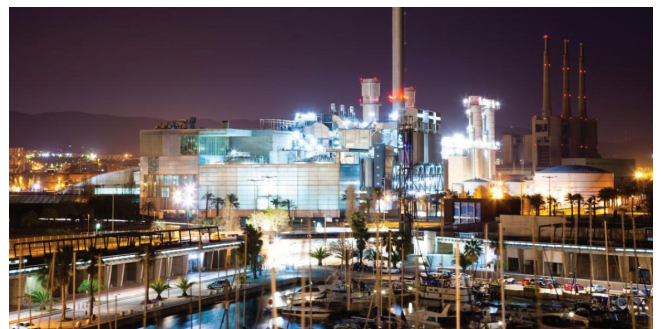
Spain's gas-burn soars in October due to price cap

Gas-burn in Spain soared 80% in October compared to a year earlier, according to Enagas figures, largely caused by the government's price cap on gas used to generate electricity. The policy, aimed to lower wholesale power prices, has limited gas generators' fuel costs to €40/MWh for six months until October and is followed by prices rising by €5/month through to May 2023.

The schemes helped to decouple gas and electricity prices by setting a ceiling of €40/MWh on the gas supply costs which Spain's large number of combined-cycle power plant operator can hand through to customers in their electricity prices. Plant operators receive a compensation, which covers the difference between the actual supply cost (the MIBGAS prices) and the cap imposed by the mechanism.

The cost for the measure stacks up to €6.3 billion in Spain and €2.1 billion for a similar scheme in Portugal, both of which having been approved by the European Commission in June under EU State aid rules.

Though the mechanism has proved very effective in containing the wholesale electricity price, critics dismissed it a "counterintuitive" to the EU's efforts to reduce gas demand. But the Spanish government defended the policy intervention, arguing end-customers on the Iberian Peninsula are more exposed than fellow consumers in many other EU countries to swings in electricity markets. This is because industry as well as most



Endesa power plant in Barcelona

household customers in Spain by electricity on contracts tied to fluctuating wholesale prices. ■

Gas to Power Journal

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Continued from page 1

down has slowed down economic growth and energy consumption.

Trade flows may well look very different in 2023: In the event of no Russian gas deliveries to the EU and China snapping up most of the length in LNG supply, Europe will struggle to refill its gas storages over the summer. The absence of Russian gas and tight LNG market would leave a gap of up to 30 Bcm – nearly half the gas required to fill storage sites to 95% capacity by the start of the 2023-24 heating season. The IEA's calculation assumes a 11% decline in gas demand in the EU and in the UK during the November 2022 – March 2023 period and that Europe's gas storages will be around 30% full at the end of this winter.

Danger of complacency

These days, low demand amid unseasonably

mild weather and healthy gas storage has made European buyers relax somewhat. The combination of lower-than-normal gas demand in October and persistently strong LNG inflows has put strong downward pressure on day-ahead prices, which fell below \$10/MMBtu by the end of October – against an all-time high of \$100/MMBtu at the end of August.

"But Europe is not out of the woods yet," Birol stressed, warning the bloc is "set to face an even sterner challenge next winter." He called on governments in the EU to accelerate the deployment of renewables and heat pumps as a step to structurally reduce gas demand.

The IEA will soon present a plan to secure Europe's gas balance for next winter, outlining concrete policy actions to refill storages and to structurally reduce gas consumption during the winter. ■

Wholesale power prices in New England could jump 60% this winter

New England could see wholesale power prices soar up to 60% this winter due to gas pipeline constraints, low fuel inventories and uncertainties about LNG shipments, analysts warn. On cold winter days, New England imports costly LNG when pipelines freeze up and power generators like Exelon seek to pass on these higher fuel costs to end-customers.

Chicago-based Exelon approached the U.S. Federal Energy Regulatory Commission (FERC), suggesting it would keep operating two gas-fired power plants and the LNG import facility in Everett between 2022 and 2024, if it gets permission to collect about \$1 per month from all electricity customers in New England.

Almost all LNG shipments to New England are sourced via Constellation Energy's Everett regas facility in Boston Harbour and Exelon's Northeast Gateway in Massa-

chusetts Bay. This past winter, the two terminals received nine LNG cargoes from Trinidad and Tobago, totalling 16.8 billion cubic feet. Exelon uses most of the imported LNG to generate electricity at its massive Mystic power station.

With 1,413 MW nameplate capacity, the six-unit Mystic plant is considered "system relevant" by ISO New England. Units 8& 9 rely on LNG brought in via tankers, rather than gas brought in by constrained pipelines. But it is exactly the high-priced LNG that render Mystic 8&9 uneconomic, the operator said, stressing

it will retire both units after the Cost of Service agreement expires on May 31, 2024.

Counting the costs, Exelon it needs to earn nearly \$219 million in revenue through 2023 to make operations of the two units eco-

nomically viable, and nearly \$187 million in 2023-2024. This cost estimate is based on an overall rate of return of 8.46%, a cost of debt of 4.76% and a return on equity of 10.26%.

Displacing LNG with domestic dry gas

LNG imports to New England fell to 0.08 Bcf/day in the first half of this year, down from the five-year average of 0.2 Bcf/d, according to US government data. Utilities and industry try to stay clear of comparatively expensive LNG and seek to displace it with domestic dry gas and imports from Canada.

But freezing winter weather can cause pipeline damage and made monthly gas prices at Boston's regional trading hub – the Algonquin Citygate – reach \$25/MMBtu during the winter of 2014. On such peak demand days, LNG remains the key marginal source of supply and contributes up to 35% of the gas supply in the north-eastern US state – a stark difference to other states where electric generators benefit from the growing production of comparatively cheap dry gas in in Appalachia, Permian and Hayneville. ■

U.S. natural gas pipeline infrastructure in New England (2022)



Eight CCGTs with over 7.7 GW capacity get added in the US this year

Eight new combined-gas turbine power plants have been commissioned or will come online in the US this year, adding 7,775 MW of electric generation capacity. The projects reverse years of decline in CCGT plant start-up, the government's Monthly Electric Generator Inventory shows, and analysts expect CCGT capacity to reach nearly 290 GW by year-end.

CCGTs are the single largest source both in terms of installed capacity and electricity output. This year, the electricity output from the entire US fleet of CCGTs is projected to rise from the 1,326,278 Gigawatt-hours (GWh) it produced in 2021, which

was 32% of total electricity generation last year. Shares of coal-fired plants (22%) ranked second, and nuclear sources (19%) ranked third in terms of electric-generating capacity and electricity generation in 2021.

Seven of the eight CCGTs opening this year are located either in the upper Midwest

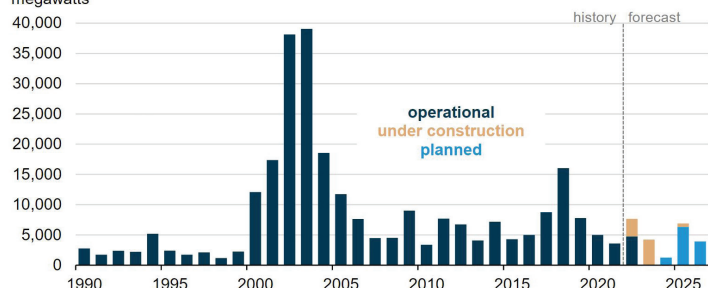
helping to replace the 5,346 MW coal-fired capacity that is retiring this year, followed by another 3,774 MW of coal capacity to be shuttered in 2023.

In Florida, the 2,222 MW of new CCGT capacity are more than enough to replace 1,486 MW of coal-fired capacity retiring this year. In Michigan (in the MISO region), 1,403 MW of new CCGT capacity will replace the 1,560 MW of existing coal-fired generating capacity that will retire this year.

Five CCGTs to be added in 2023

The US Energy Information Administration (EIA) forecasts 4,215 MW of CCGT capacity will be added in 2023, when five new plants are slated to open. All of those units are currently under construction; hence operations should be able to begin before the end of next year, analysts reckon. ■

U.S. annual capacity additions from combined-cycle natural gas turbine plants (1990–2026)
megawatts



Data source: U.S. Energy Information Administration, *Monthly Electric Generator Inventory*, *Short-Term Energy Outlook*

Falling demand for fossil fuels makes emissions peak in 2025, IEA finds

The upside for coal from the current gas supply crisis will be temporary as renewables, supported by nuclear power see sustained gains. The International Energy Agency (IEA) forecasts coal use to fall back within the next few years, gas demand to plateau by 2030 and oil demand to ebb off from the mid-2030s, making global emissions reach a peak in 2025.

The rupture in Russian energy exports to Europe in the wake of the Kremlin's invasion of Ukraine made prices for fossil spiral which is hastening the transition to clean energy sources, the IEA stated in its World Energy Outlook 2022.

Gazprom's cutbacks in gas supplies to Europe and sanctions on imports from oil and coal from Russia pushed up gas spot prices to unprecedented levels, regularly exceeding the equivalent of \$250 for a barrel of oil. Coal prices also hit record levels, while oil rose well above \$100 per barrel in mid-2022 before falling back.

Soaring gas and coal prices accounted for 90% of the upward pressure on electricity costs, accelerated inflation and created a looming risk of recessions – as well as a huge \$2 trillion windfall for fossil fuel producers above their 2021 net income.

Stringent policies herald a fossil peak

Governments enacted price caps and subsidies to shield consumers from the impact of the crisis, but many are taking longer-term steps like diversifying oil and gas supplies, reviving nuclear power and accelerating the renewable energy build-out. The most notable responses include the US Inflation Reduction Act, the EU's Fit for 55 package and REPowerEU, Japan's Green Transformation (GX) programme, Korea's aim to increase the share of nuclear and renewables in its energy mix, and ambitious clean energy targets in China and India.

"Today's stronger policy settings bring a fossil peak into view," IEA analysts reckon. From 80% today – a level that has been constant for decades – the share of fossil fuels

in the global energy mix falls below 75% by 2030 and to just above 60% by mid-century. Energy-related emissions, consequentially, will reach a high point of 37 billion tonnes (Gt) per year in 2025 and then fall back to 32 Gt by 2025.

Carbon-intensity falls amid record RES additions

Global CO₂ emissions from burning fossil fuels will grow by just under 1% this year due to record renewables deployment and fast uptake of electric cars, the International Energy Agency (IEA) forecasts. This year, energy-related emissions are on course to increase by around 300 million tons to 33.8 billion tons – rising just a fraction of their massive jump of nearly 2 billion tons in 2021 triggered by the rapid global recovery from the pandemic.

"The encouraging news is that solar and wind are filling much of the gap, with the uptick in coal appearing to be relatively small and temporary," said IEA Executive Director Fatih Birol. Solar PV and wind power are leading the rise in renewable power generation in 2022 by adding more than 700 TWh in electricity output. Without this increase, global CO₂ emissions would be more than 600 million tonnes higher this year, IEA analysts underlined.

Coal is expected to post the next largest increase with global CO₂ emissions from coal-fired power generation are set to grow by more than 200 million tonnes, or 2%, this year, led by increases in Asia. In contrast, the rise in European coal use is expected to be temporary given that new renewable projects will add around 50 GW of capacity in 2023. ■



Plant Barry in Bucks, Alabama

GE-led carbon capture to curb 95% emissions of 'Plant Barry'

GE Gas Power has been awarded \$5.7 million in US government funding to cut 95% of carbon emissions at Alabama Power's 2,370 MW 'Plant Barry.' To that end, the combined-cycle unit will be retrofitted with Linde's Gen 2 carbon capture solution based on BASF OASE blue technology. Commercial deployment needs to commence by 2030.

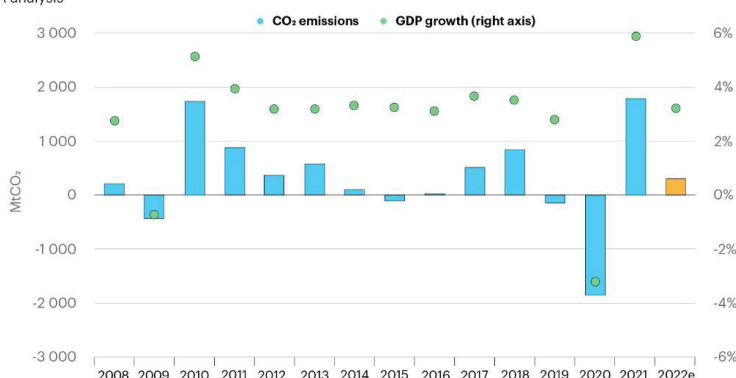
Alabama Power's James M. Barry Electric Generating Plant, also known as "Plant Barry" is a coal- and natural gas fired generator situated in Bucks, Alabama, powered by two GE 7F.04 gas turbines. In a front-end engineering design (FEED) study, GE looked at integrating the CCGT units with carbon capture utilisation and storage.

"Plant Barry" is the reference plant for the FEED study which will receive \$5,771,670 in federal funding from the U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management once the award negotiations are completed successfully. However, the funding for CCUS applications is contingent on the retrofitted power plants to start operations by 2030.

Eager to stick to this timeframe, GE will work with Alabama Power's parent Southern Company, Linde, BASF, and Kiewit to integrate carbon capture with a combined-cycle power plant. Apart from retrofitting the GE 7F.04 gas turbines with Linde's post combustion amine-based carbon capture processes, the project will also enhance the steam turbine to improve output and performance.

Broadening its scope, GE stressed this retrofittable solutions can later be applied to other power generation units. "Plant Barry" is meant to serve as a template for lowering carbon emissions across more than 1,500 F-Class gas turbines worldwide, which currently deliver up to approximately 280 GW of electricity daily. ■

Annual change in CO₂ emissions from global fossil fuel combustion
IEA analysis



Note: 2022e - estimate

Certarus supplies H2 and blending gear to A.J. Mihm power plant

Certarus' mobile energy distribution platform has supplied more than 1,000 kilograms of hydrogen at blend rates up to 25% at WEC Energy's 56 MW A.J. Mihm gas-fired power station near Pelkie, Michigan. The hydrogen co-firing was tested at one of the plant's 18 MW Wärtsilä gas engine across multiple loads, substantially lowering emissions while maintaining the electricity output.

The hydrogen fuel tests at the A.J. Mihm gas peaking plant were carried out by a partnership between Wärtsilä, WEC Energy Group, the Electric Power Research Institute (EPRI) and construction company Burns & McDonnell.

Engineers pointing out the blend gener-

ated "efficient power" and fewer CO₂ and methane emissions compared to natural gas. "We are extremely encouraged by the results of this project and believe it is a key step in advancing the technologies required to meet our customers' carbon reduction targets," said Richard Cheng, Certarus' Vice President, Hydrogen.

Certarus has supported over 20 hydrogen customers to date to safely transport hydrogen across North America for use in power generation or industry. The company's mobile storage units deliver com-

pressed hydrogen gas and liquid hydrogen directly to customer sites.

Hydrogen is seen as a key fuel to decarbonise gas peaking plants and help accelerate the wind and solar power build-out. "As we bring more renewable energy online, we must ensure that we can keep the lights on when the sun is not shining and the wind is not blowing. The results of this project are a strong indicator that these dispatchable units can run on very low- and no-carbon fuels," said Gale Klappa, executive chairman of WEC Energy Group.

EPRI supported the development of the project and led the technical implementation. Engineers at EPRI vowed they will share a complete analysis of the project in early 2023, to inform the energy industry on ways to use hydrogen in recip internal combustion engines. ■



Certarus mobile platform supplies H₂ to the Mihm power station

GE cleans up Shell LNG plants by firing H2 in turbines for liquefaction

GE Gas Power helps decarbonise Shell's LNG supply by co-firing hydrogen in B&E-class gas turbines used to liquefy the natural gas prior to shipment. Most emissions in an LNG facility stem from firing gas in power gen and mechanical drive turbines, so switching to a clean fuel is vital as global LNG demand is projected to double by 2040.

Deep decarbonisation of LNG export facilities presents both technical and economic challenges, but Shell wants to tackle them to realise its ambition of becoming a net-zero energy business. Clean fuel, produced through Shell's Blue Hydrogen Process will be used to co-fired the gas turbines at the company's liquefaction plants.

GE's 6B and 7E gas turbines can already run on 100% hydrogen today emitting up to 25ppm NO_x with the use of water in diffusion combustors. As part of this development agreement, GE wants the turbines to

fully run on hydrogen without the use of water while still maintaining NO_x emissions.

A new DLN combustor will become the backbone of a retrofitable solution for either new or existing 6B or 7E gas turbines to curb emissions in industrial applications and LNG

operations, particularly where water usage is challenging. DLN combustors are more efficient and do not use water as a diluent, with GE pointing out at up 32,000 litres of water per hour are saved using DLN systems versus comparable alternatives.

From desert climates to the tropics to the arctic cold, the B and E Class heavy-duty gas turbines can reliably generate electricity in a vast number of duty cycles. According to GE, these turbines can use more than 50 types of fuel – almost the entire fuel spectrum, including hydrogen – and can even switch fuels while running under full load. ■



mtu Series 1000, 1100, 1300 and 1500 engines ready for e-fuels

Rolls-Royce's business unit Power System has released mtu Series 1000, 1100, 1300 and 1500 engines that can run on synthetic fuels like HVO and e-diesel. These mtu engines are primarily used for onsite power generation in the industrial, agricultural and mining sector, where the use of e-fuels allows to curb emissions without compromising on engine performance.

The sustainable synthetic fuels that can be used in these mtu engine include BtL (Biomass to Liquid), HVO (Hydro-treated Vegetable Oil) and PtL (Power to Liquid) such as e-diesel. HVO, made from waste vegetable and animal fats, can be supplemented to diesel as an admixture or replace it completely. Burning HVO reduces

particulate emissions of up to 80%, nitrogen oxide emissions by 8%, and (depending on the manufacturing process and feedstock) CO₂ emissions by up to 90% compared to fossil diesel, according to mtu findings.

"To convert from conventional diesel fuel made from fossil petroleum to synthetic fuels of the EN15940 standard, no adaptation of

existing engines is necessary," said Dr Lei Berners-Wu, Vice President Global Industrial at Rolls-Royce business unit Power Systems. Customers can hence run their engines on e-fuels while maintaining the same engine performance and electricity output as if they were using conventional diesel fuel, he explained. ■



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Tokyo Gas, Marubeni set up JV for LNG-to-Power project in Vietnam

Japan's Tokyo Gas and Marubeni have established a joint venture together with the Vietnamese manufacturer Colavi and PetroVietnam Power to build an onshore LNG receiving terminal and 1.5 GW gas-fired power station in Quang Ninh province. The project will cost an estimated \$1.92 billion, with commercial operations slated to start in the second half of 2027.

PetroVietnam's subsidiary PV Power agreed to contribute 30% of the capital needed for the near \$2 billion project, though the contributions of the three other project partners are still unclear. The venture will be built by the project company, Quang Ninh LNG Power JSC, on an area of 56 hectares, including 13.38ha offshore, in Vietnam's northern Cam Pha City.

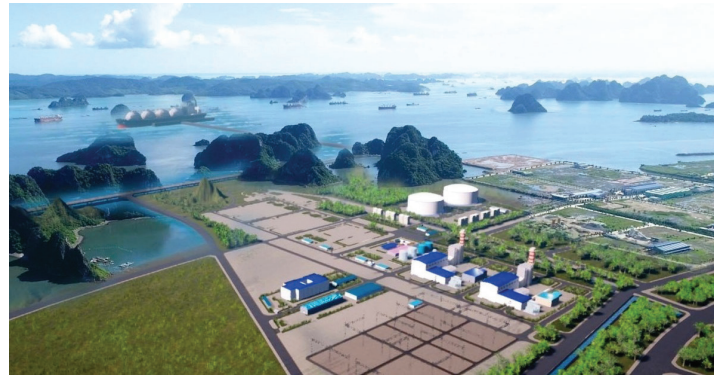
The venture will include a 1,500 MW power plant, gas storage, and an LNG port with an annual capacity of 2.4 million tonnes. But works fell behind schedule given that the consortium reportedly needs to amend and finalise a feasibility study.

LNG shipments will likely be arranged by Tokyo Gas which is understood to be close to striking a Power Purchase Agreement (PPA) with the electric power arm of PetroVietnam for all electricity produced at the Quang Ning combined-cycle plant.

Once operational, probably by the third quarter of 2027, the LNG-fuelled power station will supply some 9 billion kWh of electricity annually to the national power grid and is expected contribute some 57.7 trillion Vietnamese Dong (\$2.45bn) to the provincial budget in 25 years.

Exxon eyes rival venture at Haiphong

The Tokyo Gas/Marubeni venture is situated north of another, similar LNG-to-Power project planned for the port of Haiphong and backed by the US oil major ExxonMobil. This



Render of Quang Ninh LNG

project entails a regas terminal with a capacity of 6 million tonnes of LNG per annum and a 2,250 MW power plant that could be expanded to 4,500 MW by 2030.

Though the project received regulatory approvals and is meant to start generating electricity by 2026, ExxonMobil has yet to confirm it is going ahead. ■

Malaysia's TNB to build 2.1 GW hydrogen-ready power plant in Kapar

The Malaysian power company Tenaga Nasional Berhad (TNB) has partnered with Widad Business Group to develop a 2.1 GW combined-cycle gas power station at Kapar, Selangor, an estimated cost of 9.5 billion Malay Ringgit (\$2bn). The CCGT will be capable to co-fire hydrogen when entering commercial operations in early 2031.

The project partners secured a letter of intent (LoI) from the energy ministry to build the power plant on a site at Kapar, owned by TBN. Once fully operational, it is expected to achieve earnings before interest and tax (EBIT) of about 400 million Malay Ringgit per year.

Project finance will be arranged through a 60:40 joint venture by TNB and Widad Business Group, whose founder Tan Ikmal Opat Abdullah will be the company's "first undertaking in CCGT development." Based on the technical know-how gained from this project, Widad wants to develop more flexible gas power plants in the future

to complement its client portfolio in renewable energy.

Gas power projects like the Kapar CCGT will help TNB halve its reliance on coal generation by 2035, and slash its emission intensity by 35%. Natural gas is fuelling 41% of Malaysia's of installed power generation capacity at 15.8 GW, or 35% of its electricity output of around 60 TWh.

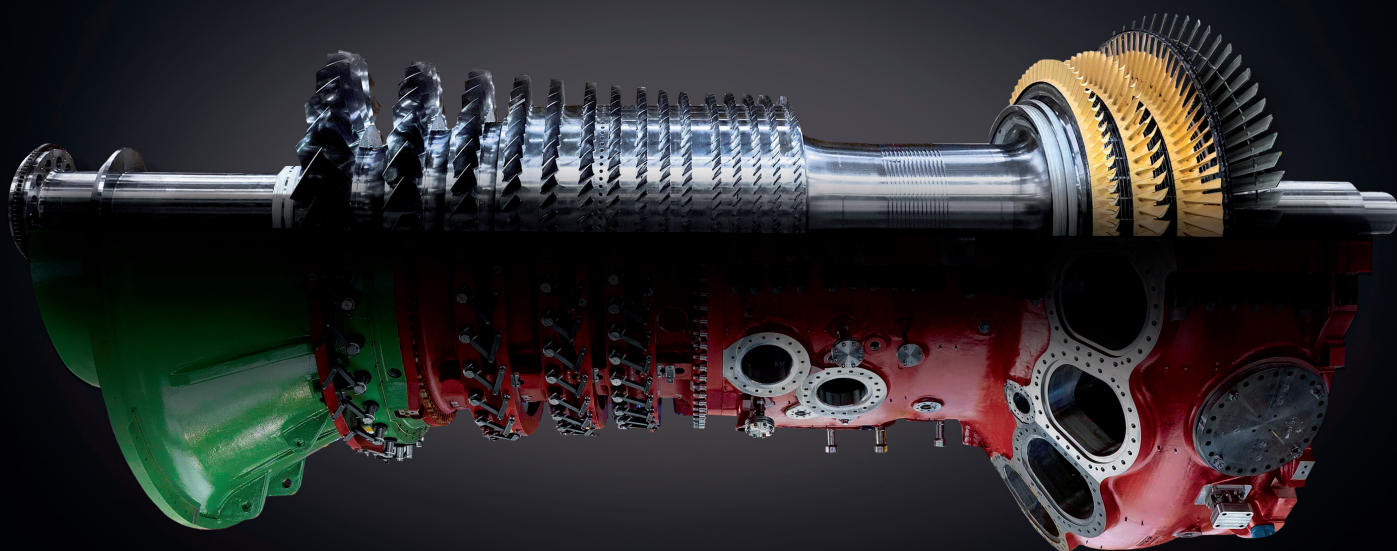
Eager to generate more electricity from carbon-free sources, TNB will revamp the 651 MW Sungai Perak hydropower plant. The utility just gained regulatory approval for its Hydro Life Extension Programme for six power stations in Sungai Perak at total cost of 5.8 billion Malay Ringgit (\$1.2bn). ■



TNB's Abdul Aziz power station near Kapar

— ITALIAN ENERGY —

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