



China's gas demand forecast to rise up to 7.2% in Nov-March period

Though China's gas demand has shrunk this year as Beijing's no-Covid policy hampered economic growth, PetroChina anticipates consumption to rebound by 5.5% to 7.2% between November and March 2023. To meet demand this winter, PetroChina procured an extra 110 Bcm of gas, half of which will be produced domestically and one third imported from Russia and Central Asia.

Domestic gas production in China increased substantially as companies increase shale drilling, while overall demand is depressed and may fall for the first time in twenty years, according to Potens' head of data analytics Kristin Holmquist. "China's LNG demand hasn't been there for most of the year as lockdowns continue which has taken a toll on the economy and on the demand for gas," she said in a podcast. China consequently resold a lot of cargoes, taking the profit from high TTF and JKM spot prices compared with shipments delivered under oil-linked contracts.

A PetroChina executive pointed out this year is the second time since 2005 when China's gas consumption grows at a lower rate than its GDP. While GDP is forecast to grow by up to 4% in 2022, gas demand increased by just 1% and may end up being negative this year, compared to 13% average growth rates in the 2005-2021 period.

But an early onset of cold weather this winter would propel up



gas demand both for heating and power generation. "Based on experience, a one-degree Celsius change in the average daily temperature will affect 2-3% of natural gas consumption, which means a one-degree Celsius change in the national average temperature will affect the total natural gas demand by 20 million cubic meters/day," a PetroChina executive said at an industry event.

The China Meteorological Administration expects La Niña weather patterns will herald an early onset of freezing temperatures. Sinopec sees a risk of a supply deficit in early winter if temperatures are substantially colder than average and policies to reign in the spread of the coronavirus are eased.

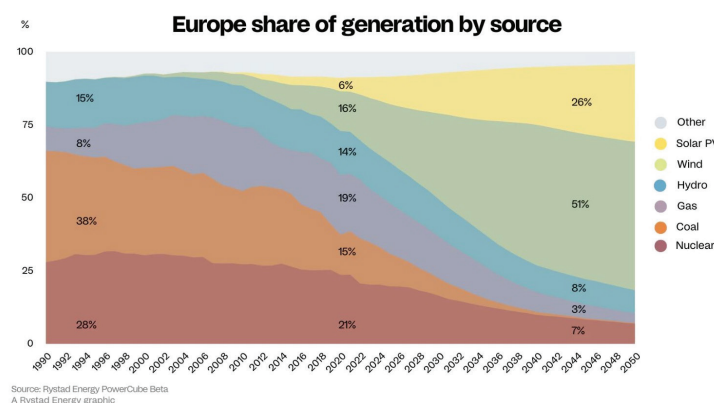
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Gas-fired power in Europe deemed 10 times more costly than solar PV

Supply challenges, high prices and falling cost of renewables are undermining the economics of gas for power generation in Europe. At today's prices, it would be 10 times more expensive to keep operating gas-fired power plants than to build new solar PV capacity in Europe, Rystad Energy said, anticipating TTF prices to stabilise at €31/MWh by 2030.

Spot prices on the Dutch TTF, the benchmark for Western Europe, have soared from an average €46/MWh in 2021 to €134/MWh so far this year amid a steep drop in Russian pipeline gas deliveries. The price jumped to a historic high of €330 per MWh in August, pushing the cost of generating electricity from gas close to €700 per MWh.

But gas-fired generation increased regardless of high fuel costs, mainly due to a 100 TWh decline in electricity output from hydro and nuclear power stations. Analysts do not expect the tight supply balance to ease over the winter as the French utility EDF cautioned it will take until 2023 to bring back online



up to 30 GW of nuclear capacity that is currently undergoing safety inspections and repairs.

With TTF prices forecast at around €31 per MWh by 2030, this puts the levelized cost of energy (LCOE) of existing gas-fired power stations closer

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Cold weather spells and a speedy economic upturn have the potential to boost China's import requirement and divert supplies away from Europe, analysts reckon. "All eyes will be on the weather forecasts, especially for the early part of the winter. There is a lot of storage available – both onshore and floating – which can mitigate some of this risk," Jeffrey More, Platts' head of Asian LNG Analytics said in a podcast. But if that storage gets depleted then spot prices are bound to soar.

Atlantic LNG cargoes get diverted

Several prompt-delivery Atlantic LNG cargoes have been diverted to Asia due to

sluggish demand in Europe amid unseasonably mild weather and healthy gas storage levels. Shipping companies are understood to be seeking a home for their cargoes, as more than 30 tankers – laden with \$2 billion combined worth of LNG – are idling off Europe's shoreline.

The number of LNG tankers queuing off northwest Europe and the Iberian Peninsula has doubled over the past two months, according to the shipping analytics company Vortexa. Another 30 tankers laden with US LNG are currently crossing the Atlantic and are likely to join the queue – unless diverted to the Pacific basin.

Anxious European buyers had been snap-

ping up LNG at almost any cost to substitute cut-off Russian gas deliveries and refill storages. According to Gas Infrastructure Europe, gas storages in Belgium are nearly 100% full, sites in France stand at 99% and in Germany at 98% capacity – leaving almost no room for additional LNG purchases.

Though high freight costs make some sellers think twice about diverting their cargoes to Asia, many are prepared to swallow that extra cost rather than keeping their vessels afloat. If winter comes late in Europe and the LNG tankers cannot discharge their cargoes, they could be late for their next scheduled loading and risk paying penalties. ■

US gas price forecast to average above 6/MMBtu this winter

With US gas storage levels 4% below average and high demand for LNG exports, analysts expect the Henry Hub gas spot price to trade above \$6.09/MMBtu through March 2023 – the highest real price since winter 2009/10. Bullish sentiment is caused by seasonal gas use for space heating and higher LNG demand once the Freeport terminal resumes partial operations in November.

The United States became the world's LNG exporter during the first half of 2022 when shipments increased by 12% to an average of 11.2 Bcf/d, according to data from CEDIGAZ. Rampant demand from European buyers, seeking to replace Russian pipeline gas with LNG, pushed up utilisation rates at the seven US LNG export facilities to 87% for most of the year.

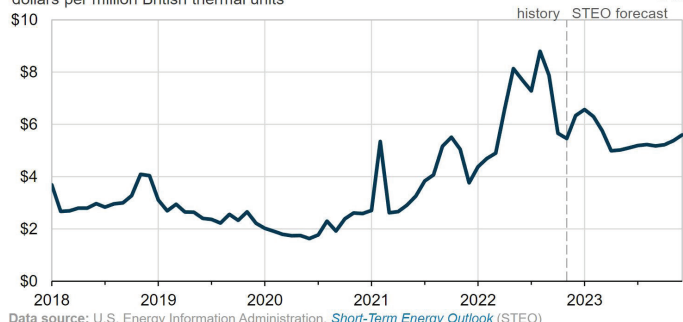
Before the fire at Freeport LNG in June, shipments from the US provided 47% of the 14.8 Bcf/d of Europe's total LNG imports, followed by Qatar at 15%, Russia at 14%, and four African countries combined at 17%. Though storages in Europe's are near maximum levels by now, buyers looking for contingency appreciate Freeport's partial

restart in November and the facility's planned full return in March 2023.

The unexpected outage had slashed US LNG exports by 11% since June and made Henry Hub gas spot prices peak at \$8.80/MMBtu in August. But prices eased to \$5.66/MMBtu in October following a period of strong dry natural gas production averaging more than 98 billion cubic feet per day (Bcf/d) every month since June.

Come spring, gas prices at the Henry Hub

Monthly U.S. Henry Hub natural gas spot price (Jan 2018–Dec 2023)
dollars per million British thermal units



are likely to begin to decline as production growth continues and winter demand for heating subsides. For 2023, analysts forecast the annual Henry Hub price to average \$5.46/MMBtu for the year. ■

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to €150/MW – three times than the LCOE of new solar PV facilities. For gas-fired plants to continue being competitive, gas prices would need to fall closer to €17 per MWh and carbon prices would need to fall to €10 per tonne, which is "currently unthinkable," explained Rystad's head of power, Carlos Torres Diaz.

At prices over €100 per MWh it is unsustainable for Europe's utilities to continue generating electricity using gas, especially when solar PV and onshore wind offer far cheaper alternatives. But change is forthcoming slowly: In Torres' view, "gas will continue to play an important role in the European energy mix for some time to come, but unless something fundamental shifts, then simple economics, as well as climate concerns, will

tip the balance in favour of renewables."

If funds needed for gas-fired generation were repurposed, more than 100 GW of new wind and solar power capacity could be developed in 2025. This estimate assumes a weighted average capital cost of solar PV and onshore wind technologies of €1.3 per Watt and that a couple of years would be needed to kick off the development.

By 2028, new renewable generation capacity installed – using money that would otherwise have been spent on gas generation – would reach 333 GW, enough to generate 663 TWh of electricity. According to Rystad calculation renewable energy output would be sufficient to replace gas-fired generation by this year, with fluctuating supplies balanced by utility-scale batteries. ■

Siemens Energy suspends dividends over wind division woes

Siemens Energy disclosed it will not pay a dividend for the full year as strong earnings at its Gas and Power segment are countered by a net loss at its wind power division Siemens Gamesa. "High inflation, material costs and supply chain issues will not go away in this coming year," CFO Maria Ferraro stressed.

In the fourth quarter, Siemens Energy achieved solid results and a strong free cash flow: Strong demand pushed up fourth quarter sales by 5.9% to €9.2 billion, while the order backlog at €97.4 billion is at a record high. Growth was led by rising demand for grid stability projects as well as for industrial application.

Showing resilience, the Gas and Power division countered global supply chain issues

by building up safety stock to ensure parts availability. "The Gas and Power segment demonstrated its ability to execute. Our transformation is paying off," CFO Ferraro commented.

Advance payments for orders at the Gas and Power segment pushed up the free cash flow to €1,503 million in the 2022 fiscal year, exceeding expectations. This high free cash flow allowed the Siemens Energy to pledge

a €1.15 billion cash tender offer to buy the remaining shares of Siemens Gamesa which it seeks to restructure.

Losses at the Spanish wind power division, due to difficulties in the ramp-up of the 5.X onshore platform as

well as supply chain delays weigh heavily on Siemens Energy's overall results. Revenue fell by 2.5% to €29 billion as growth at Gas and Power was more than offset by a rising material costs and supply chain issues at its Spanish wind power unit, as well as by a loss of revenue at its Russian division, which has been partially closed incurring losses of €200 million. Adjusted EBITA before special items fell to €379 million, compared to the €661 million achieved in the previous fiscal year.

Net loss for the year ended Sept. 30 amounted to €467 million, including the €200 million loss at its Russian division, compared to a loss of €560 million in the prior year. In light of widening losses and challenges to restructure its ailing wind power division, the board of Siemens Energy wants to pay no dividend for fiscal 2022 at the company's annual shareholder meeting in February 2023. ■



MHI head cautions Asia's exits from coal power will be "gradual"

Rather than exiting coal power in favour of renewables, Asian utilities prefer to clean up existing infrastructure by using ammonia as fuel at coal-fired power stations and switching from coal to gas. Seiji Izumisawa, president of Japan's Mitsubishi Heavy Industries (MHI) calls for a "realistic mix" of renewables and greener fossil plants to meet the region's soaring electricity needs.

"You have to think not just about renewable energy, but how to make better use of resources like coal and LNG," he told Reuters. Shifting to LNG-fuelled turbines for power generation, and co-firing hydrogen and ammonia at fossil power plants could be a near-term solution for Asian nations that still rely on coal, he suggested.

MHI recently received Japanese government funding to develop a novel technology that will increase the rate of ammonia co-firing at boilers in thermal power stations. Burning ammonia is carbon-free and the JERA-MHI team vowed to verify co-firing with at least 50% ammonia at two different boiler types by 2028.

Various pilot projects are underway in Japan to co-fired gas power stations with hydrogen, or coal power units with ammonia. Three Japanese energy majors – ENEOS, JERA and JFE – strive to set up a hydrogen and ammonia receiving and supply base at Keihin waterfront in Kanagawa Prefecture in the greater Tokyo area.

JERA, Japan's largest power producer, is committed to switching 20% of the fuel at Unit 4 of its Hekinan Thermal Power Station to ammonia by the late 2020s. As the Hekinan demo project progresses, JERA now wants to procure and import ammonia at large and supply it to various regional power producers. In mid-February, it conducted a competitive bid to procure up to 500,000 tons of ammonia per year under a contract running from 2027 until the early 2040s.

Indonesia, the world's largest coal exporter, relies on the emission-intensive fuel to cover about 65% of its electricity and process heat needs. Indonesia's state oil company Persero and Cirebon Electric Power (CEP) just opened discussions to accelerate the retirement of

Cirebon-1, a 660 MW power plant owned by CEP in West Java, under the Asian Development Bank's (ADB) energy transition mechanism.

ADB financing will be provided to retire existing coal-fired power plants on an accelerated schedule and replace them with clean power capacity. This replicable model is mean to be applied to other IPPs in Indonesia and other parts of Asia Pacific. ■



Industry demand gives BarMar the upper hand over MidCat

BarMar, a proposed pipeline to connect Barcelona and Marseille, has gained the upper hand over the rival MidCat pipeline project across the Pyrenees. The undersea BarMar pipeline is meant to connect two of the Mediterranean's most industrialised cities, guaranteeing ample demand for natural gas and hydrogen in addition to transporting the fuels onwards to Germany.

France had opposed the MidCat projects, claiming it would cost more than €3 billion, and its implementation would take years. Moreover, the trans-Pyrenees pipeline would have delivered gas from Catalonia to a part of France where gas infrastructure is fragmented – as opposed to BarMar which will link to Marseille's large grid, operated by GRTgaz rather than the regional Terega network.

The subsea pipeline will connect two LNG import terminals, one in Barcelona and the Fos Cavaou terminal near Marseille. Considering plans to switch the pipelines to hydrogen in the long-run, it makes most sense to link two industrial clusters, where the green fuel could meet industries' need to decarbonise. Spain cautioned, however, that BarMar will not be a quick fix for

Europe's gas supply crisis as the undersea pipeline may take seven years to build and is unlikely to be ready before the end of the 2020s.

Project partners expect EU funding will be forthcoming given that the pipeline will help central Europe get access to LNG imported to Spain and help solve the congestion of the Spanish gas infrastructure. More than 30 tankers – laden with \$2 billion combined worth of LNG – are currently idling off Europe's shoreline, unable to get a slot at Spanish regasification terminals.

These infrastructure bottlenecks have pushed down prices. Natural gas for day-ahead delivery on Spain's PVB hub has been



trading at only about \$13/MMBtu. Wood-Mackenzie pointed out that limited pipeline capacity to move gas around Europe means that local market conditions can vary widely. November 2022 futures for UK benchmark NBP gas were trading at about \$23 /MMBtu on Thursday, about 35% below the equivalent contract for TTF.

Spain's power exports grow due to gas price cap, French nuclear woes

Spain emerged as Europe's third-largest electricity exporters in the first three quarters of 2022 as the Iberian price cap on gas-fired power generation slashed electricity prices to around €155/MWh from August, while prices France remained more than three times higher. Electricity from Spain hence fills much of the large shortfall in French nuclear power output.

The price cap made gas-burn for power generation soar 80% in October, according to Enagas figures. The policy limited gas generators' fuel costs to €40/MWh for six months until October, followed by rise in prices by €5/month through to May 2023.

"Iberia could be expected to have a less painful ride ahead through the energy crisis compared to its European peers, as power prices will stay far below the levels in, for example, France and Germany," analysts said. In the short-term, prices will continue to be suppressed due to the fuel price cap but even with yearly contracts for 2024 and 2025 – Spanish power is much cheaper than in France and Germany. The Spanish 2024 yearly contract is currently trading at €113 per MWh, more than half the price of the French equivalent at €270 per MWh, which according to Rystad analysts, "points to a structural advantage in Iberia."

Strong fundamentals

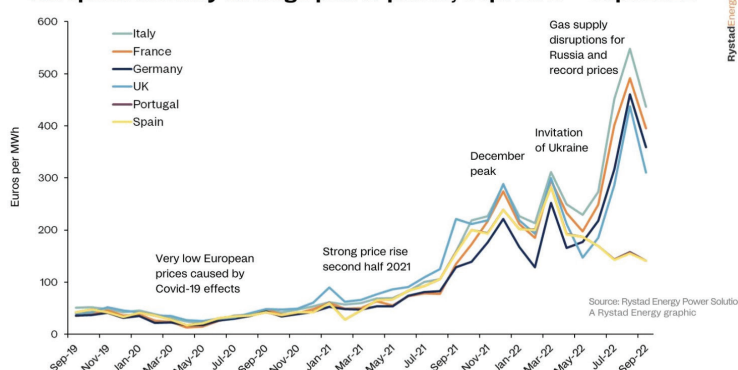
Spain's cheap forward prices are under-

pinned by strong fundamentals. While the French utility EDF had to shut down half of its nuclear power plants for corrosion issues, German utilities struggle to replace Russian gas and lower the share of coal in their power mix.

"Iberia has none of these problems," analysts stressed, pointing out Spain has no reliance on Russian gas, and the Iberian Peninsula has by far the largest regasification capacity in Europe, in addition to North African pipeline gas imports. Nuclear power will continue to deliver clean and cheap electricity for another decade, and both Spain and Portugal are close to completing, or have already completed, their coal phaseout plans.

Specifying supply, Rystad analysts estimate Algerian gas exports to Spain to reach 14.6 Bcm in 2022 and total LNG imports to the Iberian Peninsula could reach about 39 Bcm for the full year. Spain and Portugal together are home to one-third of the total European regas capacity, making the region ideally suited for gas-fired power generation alongside a massive renewable build-out.

European monthly average power prices, Sept 2019 – Sept 2022



Heat treatment 3D-printed turbine blades more resilient; MIT proves

Novel MIT-developed heat treatment transforms the microscopic structure of 3D-printed metals, making materials of blades and vanes for power generating gas turbines stronger and more resilient. Today's turbine blades are made from molten metal in conventional casting processes, while 3D printing enables more intricate designs with improved fuel use and energy efficiency — once creep issues are solved.

In metallurgy, creep refers to a metal's tendency to permanently deform in the face of persistent mechanical stress and high temperatures. While researchers have explored printing turbine blades, they have found that the printing process produces fine grains on the order of tens to hundreds of microns in size — a microstructure that is especially vulnerable to creep.

"In practice, this would mean a gas

turbine would have a shorter life or less fuel efficiency," says Zachary Cordero, the Boeing Career Development Professor in Aeronautics and Astronautics at MIT. "These are costly, undesirable outcomes."

Cordero and his colleagues found a way to improve the structure of 3D-printed alloys and transforms the as-printed material's fine grains into much larger "columnar" grains — a sturdier microstructure that should minimize the material's creep potential. The novel method is a form of directional recrystallization — a heat treatment that passes a material through a hot zone at a precisely controlled speed to meld a material's

many microscopic grains into larger and more uniform crystals.

They found that drawing the rods at a particular speed (2.5 millimeters per hour) and through a specific temperature (1,235 degrees Celsius) created a steep thermal gradient that triggered a transformation in the material's printed, fine-grained microstructure. The team also showed they could manipulate the draw speed and temperature of the rod samples to tailor the material's growing grains, creating regions of specific grain size and orientation. This level of control, Cordero says, can enable manufacturers to print turbine blades with site-specific microstructures that are resilient to specific operating conditions.

"New blade and vane geometries will enable more energy-efficient land-based gas turbines, as well as, eventually, aeroengines," Cordero notes. "This could from a baseline perspective lead to lower carbon dioxide emissions, just through improved efficiency of these devices." ■



3D-printed superalloy drawn through an induction coil

Siemens Energy develops ammonia cracker to produce hydrogen

A Siemens Energy-led consortium has begun work in Newcastle, UK, on a £3.5 million ammonia cracker prototype designed to produce green hydrogen, based on Fortescue's metal membrane purification process. The hydrogen will be used for mobility and HPU fuel cells for off-grid power but could later be scaled-up for use in industries, heat and grid-scale power gen.

At the prototype ammonia cracker, Siemens Energy and Fortescue Future Industries will produce purified hydrogen for use in GeoPura fuel cells to generate off-grid electricity. These hydrogen power units replace diesel gensets and provide zero emissions power to a range of industries, including TV production, Uniper's power plant maintenance and construction projects such as HS2 railway.

Ammonia has a high hydrogen density and is readily transportable in bulk. It can be used for storing large amounts of hydrogen in a liquid form, using existing infrastructure. Producing ammonia traditionally used 'grey' or 'black' hydrogen from either natural gas or coal, but the Haber-Bosch process produced 'green', emission-free hydrogen, using renewable energy.

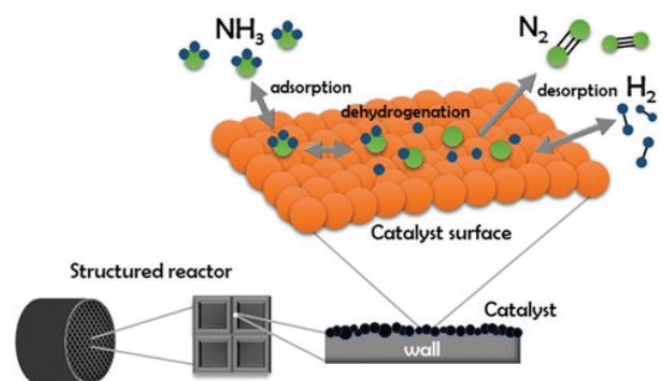
The UK government aims for hydrogen to make up to one third of the country's energy mix by 2050 but there are challenges with hydrogen storage and transport that

need to be addressed to make this viable. The ammonia cracker prototype could help tackle these issues. The cracker and the MTT purification process, if successful, will allow the green hydrogen to be recovered and delivered as high-purity hydrogen at the point of use.

"There is an overwhelming demand for supply of green hydrogen, particularly in Europe, and transport is central to ensuring that supply. We know that green hydrogen can be transported long distances as green ammonia, and, if successful, ammonia cracking coupled with MMT means that you can convert it as you need to, at the point of use," said Fortescue Future Industries CEO Mark Hutchinson.

Siemens Energy

developed a £1.5m proof-of-concept for an ammonia-based energy storage system at the Rutherford Appleton Laboratory (RAL) that turned electricity, water and air into ammonia without releasing carbon emissions. The ammonia is stored, before being used for electricity generation but cracking was not part of the RAL demonstrator so the ammonia cracker at Nottingham fills a supply chain gap in the technology. ■



Ammonia cracking process



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Tokyo Gas defers commissioning of Sodegaura CCGT by two years

The Japanese utility Tokyo Gas is delaying the commissioning of the 2 GW Sodegaura combined-cycle gas power station by about two years into the financial year starting April 2030. The cause of the delay is the need to revise an environmental assessment after the operator changed the condenser settings from sea water cooling to air cooling.

Situated just east of Tokyo, the Sodegaura CCGT will help meet rising electricity demand in the Japanese capital. The 2,000 MW gas power project is developed through Tokyo Gas' fully owned subsidiary Chiba Sodagaura Power after its project partner Kyushu Electric exited the venture in June.

The large-scale CCGT was initially planned to be built as a coal-fired power station but was switched to run on gas after the refiner Idemitsu left the project in January 2019,

saying it was not economically feasible. The site is owned by Idemitsu and the proposed gas power plant will use LNG as feedstock, sourced from an adjacent regas terminal.

Demand for gas-fired power is expected to remain high in Japan, despite high fuel prices, as the government has included these plants into its zero emissions goal if they can switch from gas to cleaner fuels like hydrogen and ammonia. Various pilot project to co-fire these clean fuels are already underway.

Striving to avert power shortages this winter, the government agreed to fund the purchase of spot LNG cargoes when private utilities cannot afford current sky-high prices. Under revised laws, the government could also mandate large industrial consumers to restrain their gas usage when supplies are scarce – prioritising the fuel for power generation. ■



Sodegaura LNG import terminal

Bahrain's Alba takes FID for Power Station 5 Block 4 project

Aluminium Bahrain (Alba), the world's largest aluminium smelter outside China, has reached financial close for Block 4 of its Power Station 5 which will add 680.9 MW and push the plant's nameplate to over 2.4 GW. Mitsubishi and the Chinese contractor SEPCO III will handle EPC works for block 4, due to start up in the fourth quarter of 2024.

The project will see the addition of a fourth combined-cycle power block in 1:1:1 configuration, though the efficiency for this new CCGT unit will be "much higher" than those of Alba's Power Station 3 and 4, the company said without specifying.

Block 4 will be powered by a M701JAC gas turbine, an air-cooled version of J-series gas turbines and a steam turbine. JAC gas turbines can run on up to 30% hydrogen fuel by volume, and Mitsubishi aims to reach 100% hydrogen fuel in the future with minimal infrastructure modification.

"By investing in efficient gas turbine, we will accelerate our energy transition and enable Alba to reduce its greenhouse gas emissions as we embrace Bahrain's objectives

to reach Net Zero by 2060," said Alba's chairman Shaikh Daij Bin Salman.

Project finance consists of a \$225 million China Export and Credit Insurance Corporation (SINOSURE) supported debt-facility and a competitive interest rate. The principal amount will be repaid over a 15-year period including a three-year grace period ■



Alba Power Station 5



Stabilizes the grid, supports the energy transition and generates sales.

mtu EnergyPacks enable intraday trading of solar power in Germany

Six out of a total eight mtu EnergyPacks have been delivered to VISPIRON's solar parks in the Germany states of Bavaria and Thuringia. Here the storage systems are used for intraday trading, allowing the green energy producer to sell stored energy at times low solar power output to help balance the grid.

mtu EnergyPacks are available with power ratings from 60 kVA to 2,000 kVA as well as a storage capacity from 70 kWh to 2,200 kWh. The modular system can be scales and easily integrated into a power producer's existing portfolio.

The flexible batteries absorb unpredictable changes in solar and wind power output and store it for later use. SETrade GmbH, for example, uses such virtual power plants combined with an auto-trading system to react to price fluctuations on the stock exchange in real time.

"With regard to increasingly volatile electricity markets, battery storage can be used to profitably market storage capacity while having a stabilizing effect on our power grids," explained Florian Schönberger, CTO of VISPIRON ENERGY GmbH.

The batteries are produced at Rolls-Royce's own plant in Ruhstorf, Bavaria. The products are offered as 20- and as 40-foot containers or as compact versions (slightly smaller than 10 feet) under the mtu brand.

In addition to the lithium-ion battery modules, the mtu EnergyPacks include electronic controls, inverters and cooling equipment. Such batteries are core components microgrids, but is also integrated into solar parks for grid stabilization, for example, or serves the charging infrastructure of e-mobility.

More than 100 mtu energy packs are already in use worldwide, Rolls-Royce pointed out. ■

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