Gas to Power Journal
Peakload Power and Energy Storage

Focus on Hydrogen Co-firing and Energy Storage

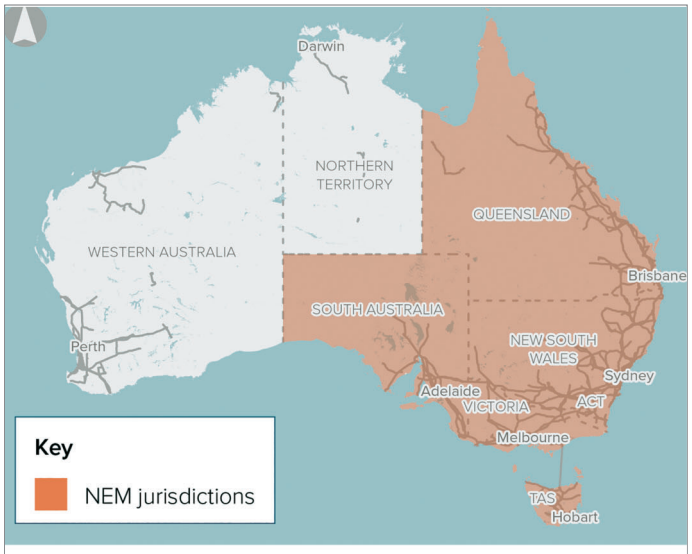
Weekly News 10 June 2022

"Australia's current electricity crisis is rather a gas crisis," EnergyQuest

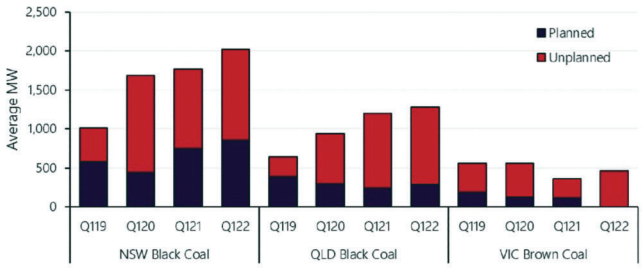
Australia's new Labour-led government is in high alert amid acute power shortages on the East Coast, but observers at the consultancy EnergyQuest say the "current crisis is rather an electricity crisis than a gas crisis." The Australian Energy Market Operator (AEMO) already dedicated firm volumes of domestic gas to power generators but thermal coal is in short supply.

The situation is particularly severe on the East Coast, where electricity demand soared as the economy keeps recovering from the pandemic, while electricity supply from coal-fired power plants fell sharply due to plant outages and problems with coal delivery from mines in New South Wales.

"Electricity demand has increased but coal generation has fallen due to coal outages and closures and problems with coal supply in New South Wales. Renewables have only been able to partially fill the gap so gas-use has jumped from supplying 6% of National Electricity Market (NEM) generation in May 2021 to 9% in May 2022 – with predictable gas price consequences," Graeme Bethune, head of EnergyQuest wrote in a market brief published this week.



The chart below from AEMO shows the increasing volume of coal generator outages in the NEM.



Coal shortages to push up gas prices

A rising number of coal power plant outages – both due to unforeseen technical issues and due to scheduled retirements – have caused an apparent shortfall in supply, according to NEM generation data for May:

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IEA head urges Germany to consider nuclear extensions

Fatih Birol, head of the International Energy Agency (IEA) has called on the German government to consider extending the runtime of nuclear power plants and make new LNG import terminals hydrogen-ready. In the months ahead, it will be challenging to secure enough oil and gas supply across Europe, he warned, proposing speed limits to help avert an energy crisis.

"This is the first global energy crisis, which is much more severe than the oil crises of the 1970s," the IEA head said. "Luckily, though, we already have alternatives in place this time, for example renewable energy sources and electric cars." Birol said the Germany's government needs to find "structural answers" to the crisis and to not lock in fossil power investments. As an example, LNG terminals should be built hydrogen-ready, he said, suggesting: "If you spend 15 or 20% more, they will also work with hydrogen."

Isar-2 is scheduled for shutdown at the end of this year

No new nuclear, but keep existing ones running

Longer runtimes for the three remaining nuclear plants would be "technically feasible", Birol is convinced. "I don't think that new nuclear plants should be built; this would take forever. But it can help to make the most of the existing plants."

Under current legislation, Germany's remaining three nuclear plants — Emsland, Isar-2 and Neckarwestheim — will be powered down by the

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AGENDA

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While total power generation output for all fuels was up 2%, or +0.3 TWh, the share of coal-fired power fell by 7.8%, or -0.9 TWh to 10,323 GWh – a shortcoming that could be only partially compensated by gas peaking plants whose output soared 55% to 1,600 GWh.

In terms of renewable energy supply, solar power staged a 5.2% rise in May, contributing 81 GWh more to total supply on the Australia's East Coast, while wind power increased by 9% or 200 GWh and hydroelectric was up 27.4%, or 400 GWh.

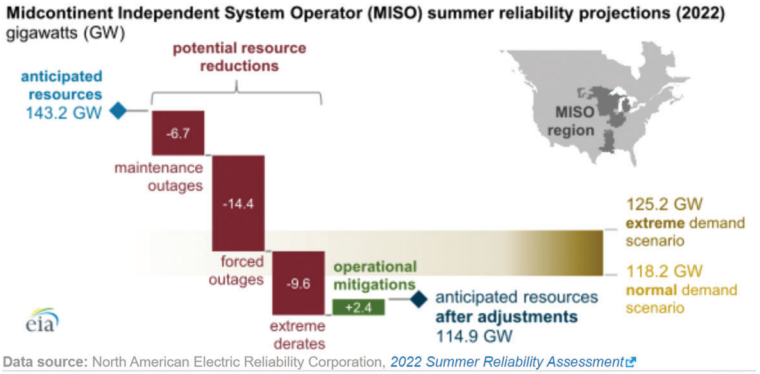
While gas peaking plants have been ramped up to cover the immediate electricity shortfall, so far there is no notable impact on LNG exports. Unlike last summer, when some cargoes from Queensland, destined for overseas markets, had to be rerouted to import terminals in Victoria and New South Wales.

Queensland is the heart of Australia's LNG industry, and home to three liquefaction and export terminals on Curtis Island: Queensland Curtis LNG, operated by Shell, Australia Pacific LNG, operated by ConocoPhillips, and the Santos-run Gladstone plant.

According to EnergyQuest, there has not been any big change in LNG exports. In May 2022 the east coast exported 1.98 million metric tons of LNG, down slightly from 2.07million tons in April and the same as 1.98 million tons in May 2021. ■

NERC assessments finds risk of potential power failures in central U.S.

Tight reserve margins raise the risk of power failures in the Midcontinent Independent System Operator (MISO) balancing authority this summer, the latest assessment of North American Electric Reliability Corporation (NERC) shows. Though MISO's anticipated reserve margin is 21.2%, a combination of high demand and supply outages could reduce the margin to critical levels, analysts warn.



Based on MISO forecasts and risk assumptions, the grid operator expects that hourly electricity demand could reach 118.2 gigawatts (GW) in normal conditions and 125.2 GW in extreme conditions. These values assume that the available demand response measures to lower electricity demand have already been deployed.

On the supply side, MISO expects to have 143.2 GW of available capacity this summer. However, planned maintenance and forced outages could reduce the available capacity. In the past five years, MISO has had an average of 6.7 GW of maintenance outages and 14.4 GW of forced outages in the summer.

Drought, low-wind conditions, or fuel supply limitation have further reduced MISO's summer electricity supply by as much as 9.6 GW in the past five years. To counter some of these outages and derates, MISO has identified 2.4 GW of capacity it can call on during emergency conditions, which are labelled operational mitigations in the NERC report. Accounting for these reductions and mitigations, MISO's anticipated resources could total 114.9 GW, or less supply than its normal demand expectation.

To counter long-run capacity shortfalls, MISO is keen to have fast-ramp gas peaking plants within its generator fleet to brace for sudden demand spike, e.g. due to extreme whether events. In addition, MISO holds forward capacity auctions to provide revenue to generators that commit to being available in future periods. The most recent auction showed a risk of insufficient capacity in most regions due to the continued retirement of electric generating capacity. ■

Continued from page 1

end of 2022. Operators of the three nuclear plants say the technology costs to extend the runtime at this stage would be "prohibitively high. "

Like most EU countries, the Germany government has sought to reduce its reliance on Russian fossil fuels by finding alternative supply sources, accelerating the renewable energy build-out and reducing demand through greater efficiency and energy savings. However, on motorways and a runtime expansion for nuclear power plants have repeatedly been rejected as viable solutions by leading representative of the coalition government (SPD/Green Party).

Nuclear vs. gas & renewables

A report drafted by the two Green Party-led ministries for climate and economy and for the environment and nuclear safety found that extending the remaining plant's runtime could only make a rather small contribution to energy security and increase costs elsewhere. It further found that even if the runtime is extended, refuelling problems would mean the plants could only deliver additional electricity by autumn 2023.

The plants would have to run somewhere between three and five years longer to make investments in staff and infrastructure pay off and necessary security checks would further complicate relying on the nuclear plants as a quick fix. Within that time frame, "other options will be available to guarantee a secure power supply despite a shortage of natural gas," the report concluded.

In contrast, the Bavarian branch of Germany's conservative party called for an "immediate" stop to the country's plans to phase out coal and nuclear power plants, arguing that the fast increase in energy prices must be countered by all possible means. Instead of shuttering its last remaining nuclear power plants at the end of the year as planned, Germany should let them run for another three to five years. ■

Gas to Power Journal

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Three Korean partners to build $1bn green hydrogen plant in the UAE

Samsung C&T, along with the two utilities Korea Electric Power and Korea Western Power, have agreed to build a $1 billion green hydrogen and ammonia production plant in the United Arab Emirates, their UAE cooperation partner Petrolyn Chemie announced. The plant, set to be built in the UAE's Khalifa Industrial Zone, will be capable of producing up to 200,000 tonnes of green ammonia from renewable energy through electrolysis.

"Participating companies will achieve their respective Net-Zero vision through the Project," Petrolyn said, noting they are "expected to... drive future growth in the global green hydrogen market by expanded reproduction of their future business model."

Rivalry among future hydrogen exporters in the Gulf

The UAE as well as their larger neighbour Saudi Arabia have both announced ambitious plans for producing hydrogen, destined mostly for export as Europe seeks to shift away from fossil fuels both in the transport, industry and power generation sectors. Analysts note the UEA's latest move to bring Korean partners on board for a large hydrogen production plant will depend the country's economic rivalry with the Saudi kingdom, as well other Gulf States.

Saudi Arabia' futuristic city NEOM, for example, will host a massive green hydrogen project that will produce up to 650 tons of the climate-neutral gas per day. Besides green hydrogen, the plant is also meant to produce up to 3,000 tonnes of ammoniac per day, which would be exported to Asia and Europe

The electrolysers for this plant were supplied by the German steelmaker thyssenkrupp, while the German economy ministry (BMWi) confirmed it will support the power-to-X project in the context of its national hydrogen strategy in a bid to "prepare a global market scale-up."

Aeral view of Khalifa Industrial Zone

IEA encourages Aramco to shift to green fuels

There are compelling arguments for renewables – particularly solar PV – to play a larger role in the energy mix across economies in the Middle East and North Africa. According calculations by the International Energy Agency (IEA), solar PV is already competitive, on a levelised cost of electricity basis, with the existing oil-fired generating fleet when crude oil is priced at $40/b and above.

Moreover, excess solar power can be used to produce green hydrogen and ammonia for export. The IEA hence urges Middle Eastern oil exporters like Saudi Aramco to shift from exporting hydrocarbons to exporting hydrogen and ammonia instead.

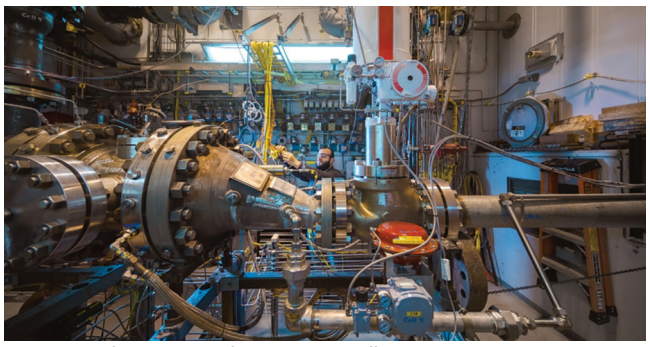
In September 2020, Saudi Arabia shipped its first cargo of "blue ammonia" to Japan, whereby emissions generated from making ammonia were captured for use in methanol production and enhanced oil recovery. IEA analysts hailed this technology as a model for MENA's oil and gas producers with cost efficient, carbon storage options. ■

GE gets funding to test components for H2 combustion at F-class fleet

GE has received over $12 million in government funding to test components for high-level hydrogen combustion, notably at F-class turbines. GE strives to reach 100% hydrogen co-firing and just worked with Long Ridge Energy Terminal in commissioning and demonstrating the first hydrogen-burning power plant in Hannibal, Ohio.

The two GE proposals were selected by the US Department of Energy's (DOE) Office of Fossil Energy and Carbon Management as part of six projects which together received $25 million in federal funding.

GE, along with rival turbine manufacturers, is striving to accelerate the path to full hydrogen-fired power generation. To that end, the American OEM last month worked with Long Ridge Energy Terminal in commissioning and demonstrating the first advanced class hydrogen-burning power plant in Hannibal, Ohio. The plant is powered by a GE 7HA.02 gas turbine, which can burn up to 20% hydrogen by volume in the gas stream initially.



View into the GRC Combustion test cell

Two winning teams in Greenville and Niskayuna

GE Gas Power's award, totalling nearly $6 million, will study of highly reactive hydrogen fuels and its challenging combustion dynamics. The project team in Greenville, SC, will develop and test gas turbine components with natural gas-hydrogen fuel mixtures and up to 100% hydrogen. This is achieved by "using a combination of micro mixer and axial fuel staging technologies," explained GE Gas Power's emergent technologies director, Jeffrey Goldmeer.

Operation of hydrogen-fuelled turbine components, meanwhile, will be evaluated on special rigs in GE's combustion test facility in Niskayuna, NY. The team will get $7 million to examine how gas turbine efficiency can be improved for both simple- and combined-cycle power generation applications.

"As everyone close to hydrogen technology knows, the technical challenges are considerable when you're talking about being able to run a turbine on 100% hydrogen. (...), we are aware of the many challenges [but] working in cooperation with the DOE, we're confident we can make even more strides that get us closer to 100%," said Keith McManus, who leads the Combustion Team at GE Research. ■

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Turning high-rise buildings into batteries

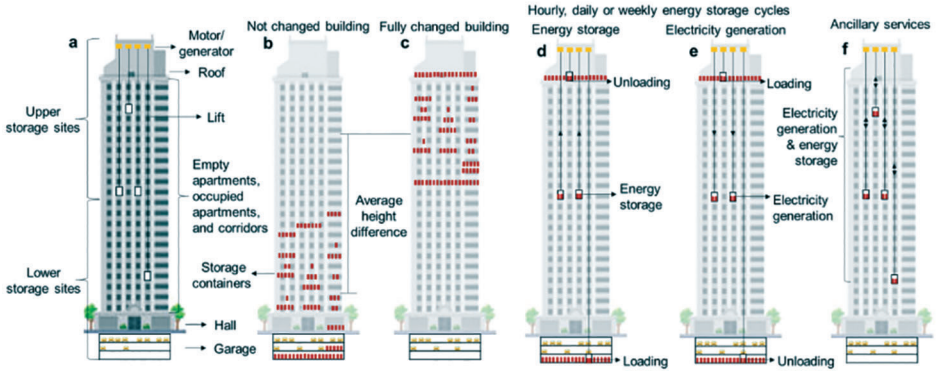
Today's rapid renewables built-out requires rising volumes of energy storage, hence IIASA researchers propose a novel gravitational-based solution that uses lifts in tall buildings. The idea is to store energy by lifting wet sand containers which are transported remotely in and out of a lift – though the challenge for making gravity energy storage viable is power capacity cost.

Importantly, the power capacity for Lift Energy Storage Technology (LEST) is already installed in high-rise building, hence it can be considered a sunk cost – if these lifts are fitted with regenerative braking systems. There are over 18 million lifts in operation globally, and many of these spend a significant amount of time sitting still. The idea is that when the lifts are not being used to transport people, it can be used to store or generate electricity.

Some details need refining

As with any new system, there are still a few details that need to be further refined before the system can be deployed. This includes finding room to store the weights the system relies on at the top of the building when the system is fully charged, and at the bottom of the building when the system is discharged. Empty apartments or corridors could be viable options in this regard.

Another consideration is the ceiling bearing capacity of existing buildings where the system is installed, that is, the total mass in kilograms per square meter that the ceiling can support without collapsing.



Lift Energy Storage Technology (LEST)

(a) system components, (b) not changed and (c) fully charged building, (d) operating on energy storage, (e) electricity generation, or (f) ancillary services mode.

Storing energy where it's needed

Being able to store energy where electricity is mostly consumed, such as in cities, would greatly benefit grid stability, hence researchers aim for LEST to provide affordable and decentralized ancillary services.

"Environmentally friendly and flexible storage technologies like LEST are set to become more and more valuable to society in a future where a large share of its electricity comes from renewables. Therefore, policymakers and power system regulators need to adopt strategies to incentivize end users, in this case, high-rise buildings, to share their distributed storage resources, such as LEST, with the central grid.

"The coordinated utilization of such distributed resources alleviates the need for investment in large-scale central storage systems," concludes study co-author Behnam Zakeri, a researcher in the IIASA Integrated Assessment and Climate Change Research Group. ■

Eni and Ansaldo team up to develop energy storage projects

Eni and Ansaldo Energy have signed an agreement to develop projects based on novel technologies for electricity storage, other than lithium-ion batteries. These validated technologies will be implemented at a number of Eni's industrial sites across Italy. The aim is to combine decentralized power generation, energy storage and renewables to overcome the latter's intermittency issues.

Enipower, one of Italy's largest providers of grid services, faces challenges to integrate rising volumes of intermittent renewable energy supply. Francesco Giunti, CEO and Chairman of Enipower said: "The initiative with Ansaldo Energia fits perfectly into the growth plans for Enipower as a provider of grid services, which are increasingly necessary – as the growth of renewables and the electrification of end-use consumption continues – to guarantee the stability of the national grid."

Alternative to Li-ion batteries

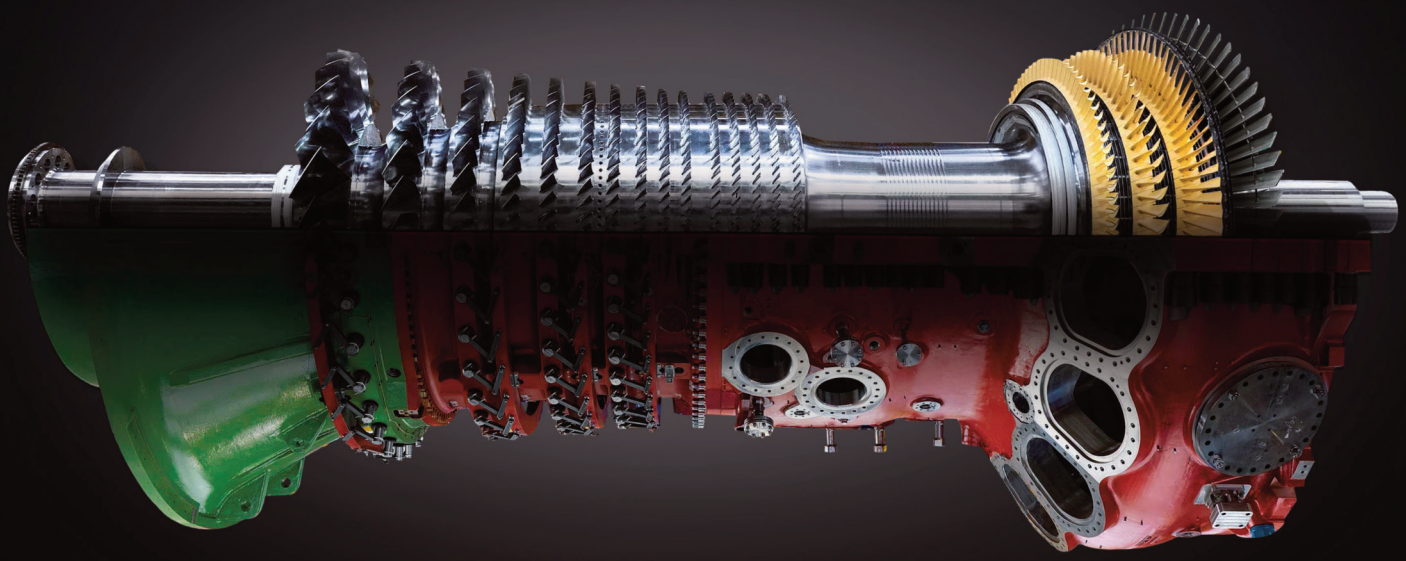
The technological solution behind the agreement – an alternative to lithium-ion batteries – is "rooted in a strong European supply chain and guarantees a safe, long-lasting energy storage service, overcoming obstacles related to disposal and avoiding problems related to critical supply issues", said Daniela Gentile, CEO of Ansaldo Green Tech. However, she fell short in specifying what novel form of energy storage technology will be used.

Daniela Gentile, CEO AnsaldoGreenTech, GiuseppeMarino, CEO AnsaldoEnergia, Giuseppe Ricci, COO Energy Evolution at Eni and Francesco Guinti, Chairman and CEO of Enipower, at the contract signing ceremony

Eni's Energy Evolution Chief Operating Officer (COO), Giuseppe Ricci explained the agreement with Ansaldo was part of Eni's approach to enact a green energy transition based on "technological leadership, the know-how of our people and the ability to transform and evolve our industrial sites." Calling wind and wind and photovoltaic "indispensable" for the success of the energy transition, Eni's CCO said the company was devoting a lot of effort and resources to growing those areas and help overcome their structural and economic limitations due to their intermittency of electricity output. ■

ITALIAN ENERGY

BRIGHTER FUTURE



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Siemens builds shore power plants in Kiel for ships and ferries

Two SIHARBOR shore power plants (50/60 Hz) will be built by Siemens Energy at Kiel's Ostuferhafen by the end of 2023. The construction contract, worth about €17 million, comprises a 50/60 Hz shore power plant for cruise ships and ferries as well as a 50 Hz plant for ferries allowing modern ships to run on electricity, rather than on-board diesel generators.

The new shore power connection at Ostuferhafen will be one of the largest installations of its kind in Europe, allowing six ships to recharge electricity simultaneously at the Port of Kiel's passenger, cargo and ferry terminals. The project includes one power plant with a capacity of 16 MVA which can supply cruise ships and ferries with a frequency of 50 or 60 Hz and a voltage of 6.6 kV or 11 kV. The second shore power plant with a grid frequency of 50 Hz is designed exclusively for cargo and RoRo vessels and supplies two berths with a voltage of 6.6 kV or 11 kV, up to a maximum capacity of 5 MVA.

"Connecting ships to shore power has enormous economic and environmental impact. Ships save expensive fuel, new business models open up for port operators, and port staff and residents benefit from a significant reduction in noise and pollution," explained Markus Mildner, CEO of Siemens eMobility.

Once operational in 2023, the two new shore power plant at Osterhafen will complement existing plants at Ostseekai and Schwedenkai as well as at Norwegenkai, also built by Siemens.

The Port of Kiel is investing in additional shore power infrastructure to reach its target to become carbon neutral by 2030, but it also wants to incentivise shipping companies to switch electrify their vessels and save emissions. "Shore power is a key part of our sustainability effort. Beginning in 2024/25, we hope to use our supply infrastructure for six ships to have around 80% of all ships plugged in while berthed," said Dr. Dirk Claus, Managing Director of SEEHAFEN KIEL GmbH. In addition to CO2 savings, connecting ships to shore power while they are at berth also results in significantly reduces noise levels and pollution. ■

eCharging station at Ostseekai in Kiel

NEWS NUDGES

Capstone wins CHP orders in Italy

California-based Capstone Green Energy has secured orders for two waste-to-energy projects on the Italian island of Sardinia. Three C65 microturbines will be deployed at two wastewater treatment facilities operated by Acciona Agua in Alghero and Cagliari. The microturbine systems are due commissioned in December this year.

FlatFish drone inspects Shell fields off Brazil

Shell and Petrobras have contracted Saipem to use its FlatFish subsea drone in pilot projects to inspect two ultra-deepwater oil and gas fields offshore Brazil in over 2,000-meter depth. Initial tests will be carried out at Saipem's base in Trieste, Italy, with a view to deploying the drone to Brazilian waters in the third quarter of 2022.

GE and partners launch 10 MW solid oxide fuel cell to electrify large ships

GE Power Conversion and its partners Ceres, Lloyd's Register and MSC Cruise Management have designed a solid oxide fuel cell (SOFC) system of up to 10 MW to electricity large ships. At this scale, SOFCs can replace conventional diesel generating sets and potentially lower carbon emissions by 47%.

The onshore power system, based on an electric microgrid, system can integrate green energy sources and has already been tested using an emulated digital twin. Developers said the system can significantly improve air quality and noise pollution when ships are in port.

"SOFC have the benefit of being able to operate on different types of new, cleaner fuels," GE said, suggesting this facilitates the transition of ship operators to greener fuels.

MSC Cruises, a GE project partner, is evaluating the use of fuel cells and cleaner technologies to power its fleet. The British port operator PD ports is looking to improve the sustainability of its ports which stretch from Teesport and Hartlepool in the North to Thames and the Isle of Wight in the South of England.

Progress towards commercialization

On shore, GE is also helping port to manage electricity and heat more efficiently. Based on PD Ports' data, experts at GE, Connected Places Catapult and Teeside University have developed a cloud-based, integrated digital concept aimed at to improve situational awareness on energy supply and demand.

Tests to optimise energy use have been carried out using an emulated digital twin platform, and Andy Cooper, UK managing director at GE Power Conversion said the teams were making impressive progress towards potential commercialization.

"Industry is investing in 'clean ship' and 'clean port' technology readiness, but it's really important we work with customers on their operational needs if the path to net zero is to be viable," he stressed. ■

PD Ports is one of GE's partners on the project

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NFE sells stake in Sergipe power plant for $1.29 billion to Brazil's Eneva

New Fortress Energy (NFE) and joint venture partner Ebrasil Energia have sold their stakes in the 1,593 MW Porto de Sergipe Power Plant for $1.29 billion to the Brazilian utility Eneva. As part of the deal, Eneva agreed to buy all shares of Celsepar which holds all rights to expand the Sergipe plant as part of a 3.2 GW project pipeline.

Commissioned in January 2022, and owned by Centrais Eletricas de Sergipe (CELSE), the flexible combined-cycle gas unit provides low-cost, dispatchable power to balance the significant seasonal swings of hydropower that makes up most installed capacity in the region of Barra dos Coqueiros, some 22 miles north of Aracaju.

Under the transaction, Eveva's takeover of both the Sergipe Power Plant as well as Celsepar, short for Elétricas de Sergipe Participações, brings the total value of the deal to an estimate $2.16 billion. "With multiple options embedded and a significant Thermal Power Plant pipeline to be developed it will allow Eneva to focus on what it does best, developing new business opportunities in Brazil having the access to gas as a cornerstone," Eneva's CEO Petro Zinner commented.

Sergipe Power Plant

NFE shifts focus to US projects

The sell-off comes as the American LNG exporter and power producer NFE focusses on ventures closer to home, such as LNG production offshore Louisiana on the US Gulf Coast. The venture, designed to export about 145 billion cubic feet per year (bcf/y) of natural gas, equivalent to 2.8 million tons per annum (mtpa), will be NFE's first 'Fast LNG' design offshore the U.S.

Following the divestment, NFE will continue to operate the 'Golar Nanook', a floating storage and regasification unit that remains chartered to Celse for the next 20 years. The agreement is subject to closing conditions, including approval by Eneva's shareholders, the Brazilian antitrust agency and the receipt of necessary consents. The transaction was expected to close in the second half of 2022. ■

MAN to install 445 MW capacity at four power plants in Bangladesh

MAN Energy Solution will supply nine engines with 150 MW combined capacity to a new power plant in Sreepur, just north of the Bangladeshi capital Dhaka. The order comes just after MAN commissioned three power plants in the cities of Chandpur, Thakurgaon and Narayanganj. The four plants will feed 445 MW of electricity into the national grid.

For the Sreepur project, operated by independent power producer, B-R Powergen Ltd, MAN will supply nine 18V48/60TS engines and get them ready for commissioning by late 2023. Energy demand in Bangladesh is increasing by over 10% each year and the 150 MW Sreepur gas power plant will help ensure a reliable power supply of the industrialised area north of Dhaka.

"When all ongoing projects are completed, MAN will provide more than 1.5 GW of capacity across Bangladesh, representing around 10% of installed capacity," said head of sales for the Middle East/Africa region, Ghassan Saab.

Chandpur Power, part of Doreen Power, recently commissioned a 125 MW power plant, based on a combination of four MAN 18V51/60TS and two MAN 20V45/60 engines. The latter is a particularly powerful, with 26 MW output per engine and over 50% fuel utilisation.

Innovative plant design

Furthermore, the four 18V51/60TS engines with two-stage turbocharging are being used in a power plant for the first time. Two-stage turbocharged units have a low- and high-pressure compressor that operate in series, which optimises power density and efficiency. "The combination of our 20V45/60 engines and the 18V51/60TS units with two-stage turbocharging guarantees maximum fuel efficiency and also enables a more compact plant design through higher power density," Saab explained.

Another 125 MW power plant in the northwest Thakurgaon district was also recently handed over to customer, Energypac Power Generation Ltd. The facility is driven by 6 × MAN 18V48/60TS engines. Situated closed to the Indian border in a difficult-to-access location, MAN had to dismantle then engines in individual parts and get them delivered by truck to the power plant site.

The fourth plant in Narayanganj, operated by Kanchan Purbachal Power Generation Ltd (KPPGL), is located 50 kilometers east of Dhaka. Driven by three MAN 18V48/60TS engines with a total output of 58 MW, the supplies electricity to the Rupganj region. ■

WEG Energy Group orders Wärtsilä engines for peaking power plant

US power producer WEC Energy has contracted Wärtsilä to deliver seven engines for a 128 MW peaking power plant. The seven 50SG gas engines will be part of a fast-ramp generating unit that will serve We Energies and Wisconsin Public Service. Delivery will take place in October, and commissioning of the plant is scheduled for March 2023.

WEC Energy Group serves 4.6 million customers in Wisconsin, Illinois, Michigan and Minnesota. The utility plans to exit coal by 2035, and intend to retire 1,600 MW of older, less efficient fossil-fuelled generation by 2025.

To fund the transition, WEC Energy allocated $54 billion to investment in wind, solar, and battery storage – and this flexible generating capacity often needs to be backed up by gas peaking power units.

Fast-starting 50SG engines can respond to the inherent fluctuations from solar and wind, helping to balance Wisconsin's electric grid. The Finish manufacturer pointed out the capability of the 50SG engine's "future proof design" which allow to convert the engine to run on various fuels including hydrogen blends.

Wärtsila earlier supplied engines for two other projects of this customer, with 188 MW combined. With the new order included, the Finish will have an installed base of more than 3,800 MW in the United States. ■

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