Gas to Power Journal
Peakload Power and Energy Storage

Focus on Electrification & Energy Storage

Weekly News 16 July 2021

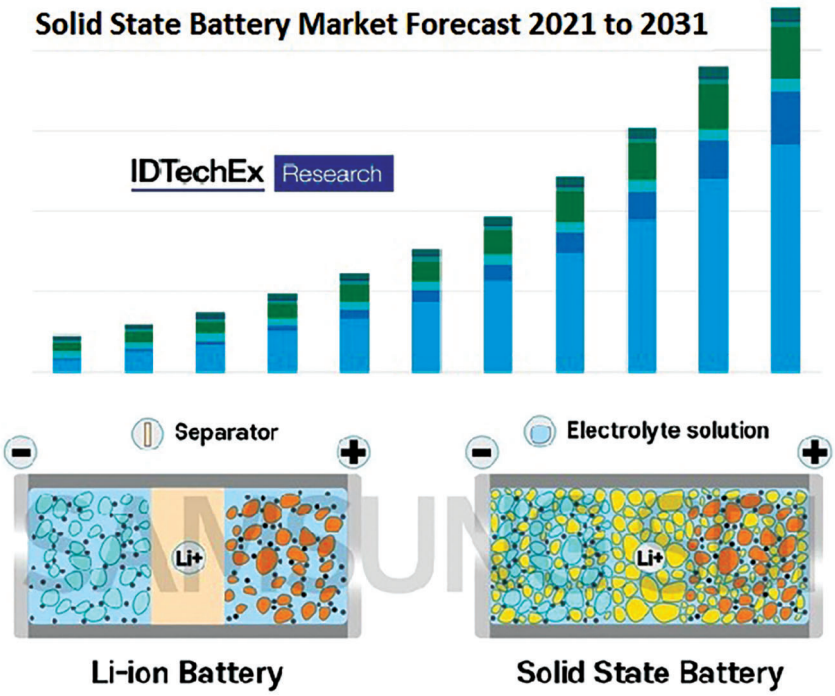
# Solid-state batteries – safer and more energetic than Li-ion batteries

**The solid-state battery market will grow to $8 billion by 2031, IDTechEx forecasts. With the larger electrochemical window of solid electrolytes – as opposed to liquid ones in lithium-ion batteries – high voltage cathode materials can be used. High-energy-density lithium metal anodes can push the energy density beyond 1,000 Watt-hours per litre (Wh/L).**

This novel battery type has solid electrodes and a solid electrolyte, instead of the liquid or polymer gel electrolytes found in lithium-ion batteries. Most liquid electrolytes in li-ion batteries are highly flammable which is a safety hazard, hence replacing organic liquid with solid-state electrolytes ensures for safer and long-lasting battery operation.

Today, demand for solid-state batteries mainly comes from electric vehicles, though energy storage systems and consumer electronics such as smart phones and laptops are also target markets. Samsung in 2020 launched solid-state batteries based on argyrodite electrolyte, while Volkswagen spent $200 million to buy a 5% stake in QuantumScape. Ford and Hyundai

continued on page 2




*Li ion vs Solid state*

# E-car rollout to cause 20% surge in German power demand

**Electrification of transport and industrial processes is likely to push up Germany's power demand by 18.7% on 2020 levels to reach up to 665 Terrawatt-hours (TWh) by 2030, the country's economy minister Peter Altmaier disclosed today. This implies a renewables and hydrogen build-out if Germany wants to meet its green energy target.**

Green hydrogen production within Germany would have to reach 19 TWh annually by 2030, some 5 TWh higher than previously expected. Wind and solar power capacity, meanwhile, would have to be increased from currently 252 TWh to nearly 426 TWh to honour Berlin's political target for renewables to make up 65% of the German energy mix by 2030.

A final electricity demand forecast, alongside more details on the electric vehicle adoption, will be published the advisory body Prognos this autumn, Altmaier announced. Germany will hold a general election on September 26 this year, hence the cost of energy and transport is closely scrutinized by the public and impacts their choice at the ballot box.

## E-cars to take over

Latest forecasts assume there will be 14 million electric cars on German roads in 2030, some

continued on page 2

## AGENDA

Continued from page 1, top story

are also invested in Solid Power, with the latter having partnered with BMW. Renault, Mitsubishi, and Nissan invested in Ionic Materials.

### Production pioneered by China

Analysts at IDTechEx anticipate the solid-state battery will take off after 2025, although small-scale production may take place earlier notably in China and Taiwan. Mass production of solid state batteries is expected to take place in China from 2022, followed by Japan and Europe from 2026.

Lithium-ion battery manufacturing, in contrast, has been dominated by Japan and South Korea. Rival producers in the US and Europe have been building battery manufacturing close to the application market.

The use of new electrolyte materials and a change in manufacturing procedures will herald a reshuffle in the battery supply chain. "The development of solid-state batteries has become part of the next-generation battery strategy. It has become a global game with regional interests and governmental supports," IDTechEx commented.

"New materials, components, systems, manufacturing methods, and know-how will open up new opportunities to further enhance the technology." ■

# Wildfire damages power lines, prompts 'flex alert' by California ISO

**A blistering heat wave and wildfires are forcing evacuations in northern California and severely damaged three major power transmission lines. With the interconnectors out of service, California ISO had issue a 'flex alert' as it misses out of 10% or around 5,500 MW of electricity imports. Emergency gas gensets still prevent the worst.**

The loss of 5,500 MW interconnector capacity is huge, considering that the loss of just 248 MW at a plant in Central Valley last year was the final tipping point to cause two rolling blackouts.

### Grid operator issues 'flex alert'

Flexible gas-fired generator sets so far manage to avert rolling blackout but the strain on the regional power transmission grid is building up. With the three interstate power links still down, officials at California ISO issued a so-called "flex alert." It urges the population to avoid using major, electricity-hungry appliances like ovens and dryers during the peak hours between 4 p.m. and 9 p.m. local time.

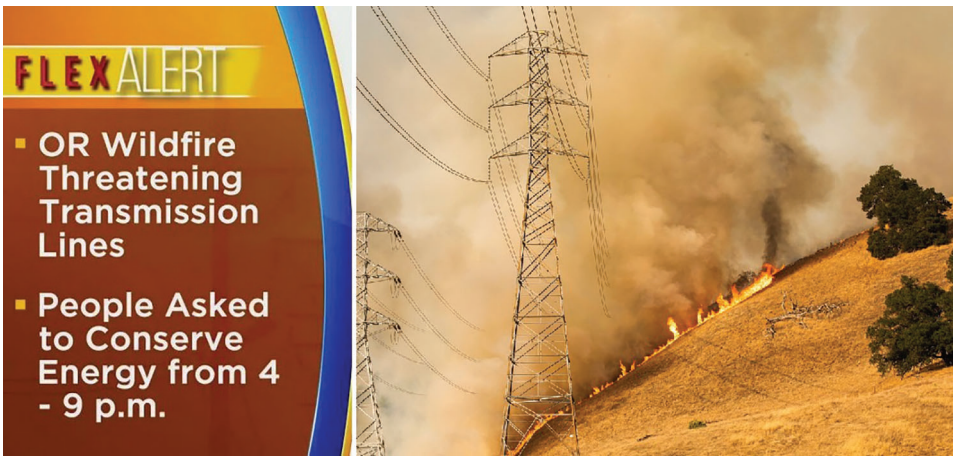
"I think all of us recognize that California has a significant amount of additional capacity it needs to put into the system here in the years ahead to adapt to changing patterns of load, and temperatures, and heat, and even the potential for extended drought," said Elliot Mainzer, President and CEO of the California ISO. "We need to get away from the edge [capacity-wise] where we are now, but it will take some time."

### Power imports from Oregon at risk

But California ISO now faces a fresh threat as Oregon's Bootleg Fire doubled in size to nearly 76,000 acres, coming dangerously close to other interstate power transmission lines. California ISO said the Bootleg Fire's growth posed an "imminent threat" to transmission lines between California and Oregon.

The grid operator hence prepares to use all its electricity reserves and sets up emergency demand programs.

Wildfires not only impact grid operators but can also be damaging to electric utility companies by causing physical damage to power plants, reduce cooling water and disrupt power plant dispatch which can cause severe financial distress. ■




Continued from page 1

6 million heat pumps installed and 30 TWh of electricity available to produce green hydrogen. Market observers noted electric cars will take up sooner than expected, requiring new policies and safety measures to ensure stable supply of electricity to charging stations.

Referring to the public's rapid switch to e-vehicles, the German association for renewable energies (BEE) has for long warned that electricity consumption in 2030 will be much higher than assumed, reaching nearly 754 TWh. Analysts at BEE explained that though energy efficiency measures managed to reduce the 'classic' power consumption and grid losses by 48 TWh, there is now additional demand of 205 TWh from heat pumps, electro mobility and sector coupling technologies, notably Power-to-X. ■

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# Merkel's visits Biden to find a "common position" on Nord Stream 2

**Tough talks about Nord Stream 2 will be held during the visit of the German chancellor Angela Merkel to US President Jo Biden. To find a "common position" on the controversial Russia pipeline link, Merkel will likely have to give a guarantee that Germany would cut off the pipeline if Russia stops deliveries through Ukraine.**


Gazprom, the Russian state-owned gas giant, is known for playing 'pipeline politics,' and has repeatedly cut off supplies or gas transits through Ukraine. Before flying to the US, Merkel hence sought to hence reassure the Ukrainian President Volodymyr Zelenskiy that Germany would "do everything to make it very clear that Nord Stream 2 is not a substitute for the promised transit deliveries through Ukraine."

Following years of armed conflict, Russia and Ukraine reached a new gas transit deal through 2024 which could be prolonged by 10 years. The EU had facilitated talks between the two foes, seeking to rebuild trust.

## Start-up slated for late September

Nord Stream 2 is already 98 percent complete and scheduled to start operations in late September, swiftly after the completion of sea-trials. Final works had been delayed over the threat of the outgoing US President Trump to impose sanctions, but the project's lead investor Gazprom stayed defiant and vowed to "go it alone, if necessary."

Various European companies – Allseas, Bilfinger and Munich Re – exited the project though actual sanctions were only imposed the Russian company KVT-RUS, the owner and operator of the pipe-laying ships.

Showing some goodwill, President Biden recently decided not to levy sanctions on German company behind the gas pipeline, Nord Stream 2 AG, and its CEO Matthias Warnig. However, there is still bi-partisan opposition in the US Congress as many decision makers see the Russian gas interconnector as a threat to ramping up US LNG exports to Europe. ■

# Sonatrach to bring Medgaz expansion onstream in Q4-2021

**Algeria's state oil and gas company Sonatrach and the Spanish utility Naturgy will bring the expansion of the Medgaz interconnector into operations in the fourth quarter of 2021. Works were costing $90 million to complete and the expanded pipeline will add 2 Bcm/y, taking total supply to 10 Bcm, or 25% of Spain's annual demand.**

Stable supply of comparatively cheap pipeline gas from Algeria will likely shift the balance in Spain's power generation mix more towards natural gas. This is in line with the government's '2021-2030 Energy Plan', dedicated to speed up the country's coal exit.

Coal-fired power units will "cease to be competitive by 2030," the plan reads, given that CO2 prices in Europe are likely to rise to €35 per ton and considering the relative price of gas. Dispatch of gas-fired generation is seen to fall slightly, down from 27.2 GW currently to around 26.6 GW in 2030. In contrast, combined heat and power (CHP) capacity could rise 0.7 GW over the same period to reach 3.7 GW.

## Medgaz ensures supply security

The 757-kiometres long Medgaz pipeline runs via Beni Saf in Algeria to Almeria in southern Spain. Once in full swing, the expanded pipeline will transport a fourth the gas consumed in Spain. Naturgy is also an LNG importer via 20-year agreements with Cheniere Energy and Novatek.

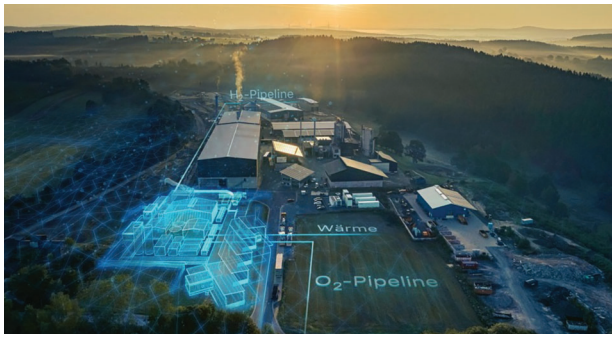
Naturgy holds a strategic 24.5% of the Medgaz pipeline and Sonatrach owns 51% after purchasing the 19.1% stake owned by Spanish oil and gas and refining group Cepsa in May 2020. The third minority shareholder is New York-based global equity fund BlackRock. ■

# Siemens builds 8.75 MW green hydrogen plants in Bavaria by 2022

**Construction has started for a hydrogen generator in Wunsiedel, northern Bavaria, realised by Siemens Smart Infrastructure. The 8.75 MW plant will produce up to 1,350 tons of green hydrogen per year from summer 2022 and allow local industries to use waste heat, or oxygen split off during electrolysis.**

At Wunsiedel, the hydrogen is produced through the electrolysis of water by only using power from wind and solar power. The result is 'green,' or carbon-free hydrogen which is delivered via truck trailers to end-customers mainly in the regions of Upper Franconia, Upper Palatinate, Thuringia and Saxony as well as Western Bohemia in the Czech Republic.

The plant uses Siemens Energy's latest generation of electrolysers as the German manufacturer continues to commercialise this technology, CEO Christian Bruch said. "The plant not only supplies green hydrogen from renewable energy sources," he explained, "it also makes full use of the resulting by-products, oxygen and waste heat." There is also an option to build a public hydrogen filling station for trucks and buses nearby.



*Render of Wunsiedel H2 plant*

## 'Locally-made' boosts acceptance

The connected infrastructure with local industries, will serve as a model for the whole of Germany. "Green hydrogen 'Made in Bavaria' demonstrates domestic technological expertise and increases acceptance through local value creation," the state's economic minister, Hubert Aiwanger said at the groundbreaking ceremony on Friday. In his view, Germany's energy transition will only succeed through multiple innovative projects on a local level.

For the 'lighthouse project' at Wunsiedel, Siemens' financing arm SFS will provide equity and hold a 45% share in the operating company WUN H2 GmbH. Rießner Gase GmbH also holds 45% and Stadtwerke Wunsiedel (SWW) the remaining 10%. In addition, non-recourse project financing was arranged with UmweltBank as an external lender.

Recent OECD analysis anticipates an 80% rise in the world's energy demand by 2050. Meeting this demand, while reigning in climate change, will require massive investment in clean energy generation, electricity distribution and digitalisation. Hence, all energy consumers – notably in the transport and industry sector – need to accelerate their decarbonisation efforts, e.g. by shifting their engines and appliances to run on hydrogen. ■

## NEWS NUDGES

### Tapping wind energy for hydrogen

Spanish utility Naturgy and the gas grid operator Enagás are evaluating the use of 350 MW offshore and onshore wind capacity to produce green hydrogen. The fuel will be used to decarbonise the steel industry and shipyard in northwest Spain.

### EU seeks to expand Green Deal to Africa

The European Green Deal should be expanded to also include African states as partners, the German development minister Gerd Müller said. Green hydrogen production in Africa, in his view, should be a "cornerstone for economic cooperation with the Europe." ■

# INNIO and Graz's LEC set new standards for hydrogen-fuelled engines

**Graz's Large Engines Competence Center (LEC) and INNIO Jenbacher have been researching and developing applications for the use of hydrogen and hydrogen-based fuels such as synthetic natural gas, methanol or ammonia. The aim is to build gas engines for distributed power that can run with a variety of carbon-neutral or carbon-free fuels.**

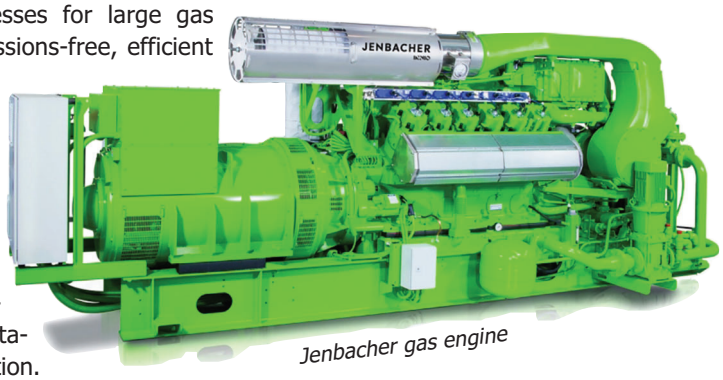
The Austrian state of Tyrol has provided €2.4 million in funding for Research and Development (R&D) in the areas of sustainable power generation and transportation systems as part of the COMET-K1 research program. The state energy policy is aimed at freeing Tyrol from its dependence on fossil fuels by 2050.

INNIO is already using hydrogen in its Jenbacher gas engines and together with LEC, this technology will be enhanced to demonstrate in 2021 that a Jenbacher Type 6 gas engine can run on up to 100% hydrogen. Carlos Lange, President and CEO of INNIO, underlined the Austrian company is striving to "expand its technological leadership in power generation based on regenerative gases. In specific, hydrogen and other renewable fuels produced from wind or solar power can be also be used for energy storage."

## HyMethShip project

"We are focusing on the development of combustion processes for large gas engines that are emissions-free, efficient and flexible in operation," said Andreas Wimmer, head of the LEC. In his view, the HyMethShip innovation project demonstrates how to eliminate CO2 emissions for marine or stationary power generation.

To prove this point, INNIO and LEC are testing a carbon-free, 2 MW gas engine in the years 2020 to 2021 as part of the EU HyMethShip project. The engine is a Jenbacher Type 6 gas engine that operates either fully on hydrogen or on methanol. ■

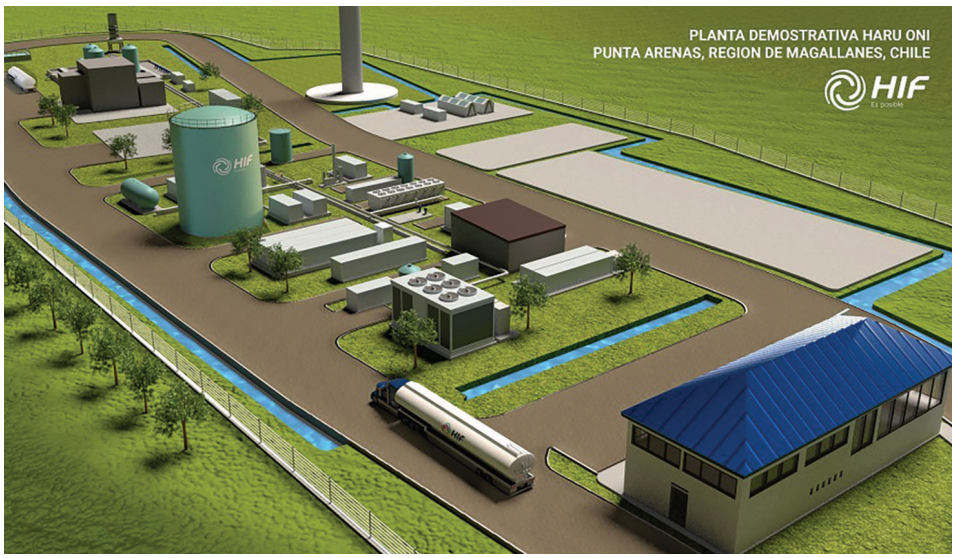


*Jenbacher gas engine*

# Porsche's eFuels pilot plant in Chile based on MAN methanol reactor

**German carmaker Porsche, together with Siemens Energy, is developing the world's first industry-scale synthetic fuels plant in Chile. The 'Haru Oni' pilot project uses wind farms around the city of Puntas Arenas to generate green hydrogen, which is then combined with CO2 filtered from the air in MAN Energy Solutions' methanol reactor to produce methanol.**

The green methanol can be converted into gasoline in a further step. Porsche said it plans to use the eFuels initially in its motorsport vehicles. The sports car manufacturer is initially investing some €20 million on the project in southern Chile.




*Render of Haru Oni eFuels plant*

## Production to start in 2022

In the pilot phase, the 'Haru Oni' plant is expected to produce around 130,000 litres of eFuels as early as 2022. In two steps, capacity will be increased to around 55 million litres of eFuels per year by 2024 and to around 550 million litres of eFuels per year by 2026.

By international standards, Chile's excellent wind conditions in southern part of the country offer "ideal conditions" for the production of green hydrogen and synthetic fuels made from it, project developers pointed out.

"Synthetic fuels are an important component on the road to a climate-neutral future. They have the potential to decarbonise all those sectors and processes where direct electrification is not possible or practical," says Uwe Lauber, CEO at MAN Energy Solutions.

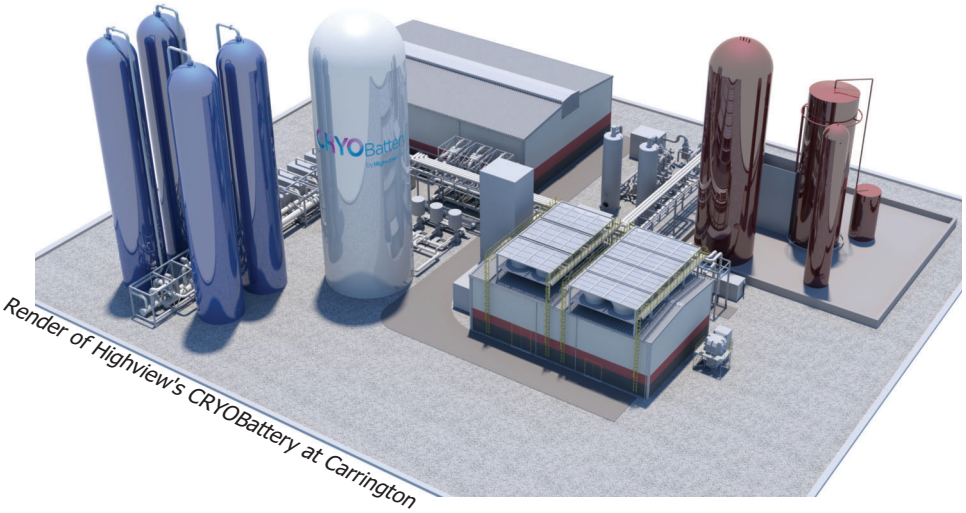
Back in 2013, MAN commissioned what is currently Europe's largest methanation reactor for Audi in Werlte. The facility has since supplied 1,500 vehicles a year with climate-neutral, synthetic natural gas. The reactor systems for producing synthetic fuels are produced at the company's Deggendorf site in southern Germany. ■

# MAN to provide LAES turbomachinery to Highview's CRYOBattery

**MAN Energy Solutions will supply turbomachinery for liquid-air, energy-storage (LAES) to Highview Power's CRYOBattery facility in Britain. Highview is building a 50 MW liquid-air, energy-storage facility – with a minimum of 250 MWh – at Carrington Village, Greater Manchester. The project is seen as "a litmus test for the future of zero-carbon storage technology."**

The energy storage plant uses cryogenically liquefied air as a medium for storing energy. Off-peak or excess electricity is used to compress ambient air and liquefy it for storage at low temperatures in insulated tanks. When power is required, liquid air is drawn from the tanks and evaporated again to generate electricity.

LAES technology is particularly well suited when large amounts of energy are needed over a discharge time of several hours, e.g. for enabling fluctuating renewable sources to bear base-loads, MAN pointed out. The company's turbomachinery train will form the core of the CRYOBattery facility that, upon completion, will become one of Europe's largest battery-storage systems.



*Render of Highview's CRYOBattery at Carrington*

## Start-up scheduled for 2022

Construction began in late 2020 with commercial operation of the battery unit set to commence during 2022.

The delivery deal for the LAES equipment follows on agreements reached in April 2021. "It has been pending for some time and (…) we have worked hard to get to this point," said Wayne Jones, MAN Energy Solution's chief sales officer.

"Carrington is a unique project and a litmus test for the future of zero-carbon storage technology, not just in the United Kingdom but globally. Indeed, many interested parties will be watching developments closely," he said, suggesting the technology's potential is "limitless" with multiple opportunities for further application. ■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# Wärtsilä provides 156 MW balancing power for Nebraska

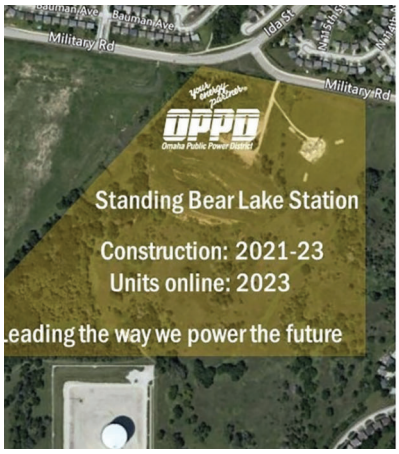
**Finish manufacturer Wärtsilä will supply generating equipment for a 156 MW engine power plant to Omaha Public Power District, a public utility in the US state of Nebraska. The multi-fuel power plant will be dispatched if and when required to balance 400 to 600 MW of solar generation.**

Under the 'Power with Purpose' project, the Omaha-based utility is increasing the share of its solar PV-based generating capacity, along with additional dispatchable balancing power. Fast-start internal combustion engines will be used to backstop the solar PV units when the sun is not shining.

With the hybrid installation of solar PV plus gas engine plant, Omaha Public Power District is getting closer to reaching its goal of net-zero carbon emissions by 2050.

## Fast-start plant due onstream in May 2023

The new Standing Bear Lake Station plant will be located in Douglas County, Nebraska, and will include nine 18-cylinder Wärtsilä 50DF engines operating on natural gas and light fuel oil as needed. The engines can burn natural gas, light fuel oil, and even hydrogen blends. Wärtsilä pointed out most of its engines can currently use 15%-25% hydrogen blended with natural gas.




The equipment will be delivered during the second half of 2022, and the plant is scheduled to begin commercial operations in May 2023.

Wärtsilä announced the latest order from Nebraska just days after a similar order for six balancing power plants in Italy. The installed capacity of Wärtsilä power plants in the United States is close to 3.6 GW, including major balancing power plants such as Plain Ends, Goodman Energy, the Denton Energy Center and the New Orleans Power Station. ■

# GE realizes 'power plant on wheels' in Oman within just five months

**GE Gas Power has agreed to supply Marafiq with four TM2500 aeroderivative gas turbines and subsequently build, own and operate a power plant for Tanweer in the Special Economic Zone at Duqm in Oman. The 80 MW plant will be realized as a 'power plant on wheels' that can be commissioned in just five months.**

Marafiq will sell all electricity from the plant to Tanweer, a rural utility, pursuant to a power purchase agreement between the two parties. Government-owned Tanweer is responsible to ensure a stable supply of electricity in various regions of Oman, including the Special Economic Zone in Duqm.

## Interim power solution

The 80 MW plane will be powered by four TM2500 turbines, and GE expects to deliver, test and commission the equipment in as little as five months' time. The facility will then be operated for a minimum of three years as an interim power solution, until the area is connected to Oman's main 400 kilovolts (kV) grid.

Tanweer's acting CEO Ahmed Al Harthy singled out Duqm as a "driver of socio-economic development in Oman," which required reliable power supply that could be implemented quickly and in a more cost-effective manner than the currently used diesel-fuelled technologies. GE's TM2500 technology offers a reliability rate of over 99%, which convinced the customer Marafiq.

## Easy to install and move

TM2500s – often described as GE's 'Power Plant on Wheels' – are trailer-mounted aeroderivative turbines that are easy to install to give "fast power" and can be redeployed from one location to another. The electricity from the gas-based TM2500 units will replace an existing diesel generator in Duqm, which are expected to curb carbon emissions by up to 90 thousand tons per year.

Joseph Anis, President & CEO of GE Gas Power Europe, Middle East and Africa pointed out "the project illustrates how switching from diesel or oil-fuelled power generation to gas can help power producers to generate more sustainable electricity, without compromising on the reliability, flexibility and affordability of power supply." In Oman, GE has delivered various gensets for the country's oil and gas exploration industry and provided nine F-class turbines for projects in Dhofar Governorate. ■


*GE's trailor-mounted TM2500 turbine.*

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