



Weekly News

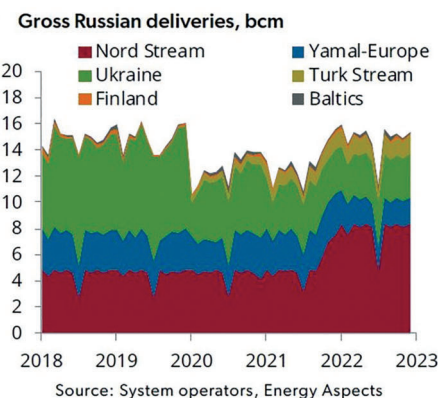
30 July 2021

First flows through Nord Stream 2 expected in mid-October

Regardless of US approval, the Nord Stream 2 pipeline still needs to be given a license to operate by the German regulator BNetzA which is "unlikely to materialise before mid-October," Energy Aspects assumes. LNG imports will have to make up for the missing supply, pushing up prices at the Dutch TTF gas trading hub.

The German Chancellor Angela Merkel and US President Joe Biden had agreed the controversial Baltic Sea interconnector can come onstream, though Russia must be prevented from "using energy as a weapon". If Gazprom halts flows through Ukraine, the West will impose sanctions. The Russian gas link to Germany is 98% complete and ready for start-up in September.

Before the cheaper Russian gas will start flowing to northern Germany and onwards to western Europe, utility buyers will have to turn to LNG. Analysts hence see prices at the TTF to rise within the fuel switch range for delivery this winter, analysts say. On the curve, TTF Dec-21-Feb-22 contracts are currently priced around the coal-to-gas fuel switch trigger where gas-fired plants have a 15%



efficiency advantage over coal-fired units. But any significant tightening of the balance could see outturn prices rising to the 20% trigger, Energy Aspects warned.

Risk of licence delays

Following Biden's tacit consent, residual US sanctions against Nord Stream are off the table but analysts still see a risk for delays on the licence to flow. The German regulator BNetzA typically takes about four months to issue a draft decision on granting an operational

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Capex of oil & gas majors rebounds to 9% by 2022 – Fitch forecasts

Capital expenditure of oil and gas companies will rise around 3% in 2021 before accelerating to 9% in 2022, Fitch Rating forecasts, though this is "not enough" to recover to pre-crisis levels. The pandemic had reduced 2020 corporate Capex by €36 billion, or about 7% compared to 2019 amid crippling lockdowns.

This decline was still modest versus a 14% drop in revenue, as continue growth in spending among telecoms and utilities helped balance cuts among the industrial, natural resources-related sector, analysts explained.

Europe's rebounds "swiftly"

Most western European companies are likely to rebound swiftly and should recover above 2019 levels by the end of 2021, Fitch Ratings forecasts in a new report. Spending in emerging markets will take an extra year to return to pre-pandemic levels, reflecting the differing mix of industries.



While the recovery of the oil & gas sector stayed relatively subdued, metal producers enjoy a more rapid rebound that takes Capex 20% above the 2019 total, surpassing pre-pandemic levels.

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licence and a further two months for a final decision.

From the first application on June 11, the four month approval period would mean that first flows of Russian gas will be unlikely to reach Germany before the middle of October. On the flipside, Energy Aspects is assuming earlier flows through the second string of Nord Stream 2 – likely as early as December, given that it now looks like the Danish section of line is already complete.

Late flows incur costs

If the regulator takes the maximum period to issue a license — six month — then first flows would start in mid-December. That scenario heralds a drop of up to a 4.8 billion cubic meter (bcm) in Russian gas deliveries in the fourth quarter, compared to Energy Aspects' forecast.

Gazprom would, in this event, have to heavily rely on existing Ukrainian and Polish transit capacity which could incur some extra

cost. It would also have to fully use the 15.8 bcm per year European leg of TurkStream from the start of the fourth quarter, as the 6 bcm per year Serbia-Hungary interconnector is on time for a start on October 1.

If worse comes to worse, Gazprom would have to meet contractual obligations to its European clients by delivering hub-bought gas or LNG. This would cost the Russian gas giant dearly; hence all eyes are now on the timing of BNetzA's flow license. ■

Gazprom "ready to transit gas across Ukraine" even after 2024

Russia's state-controlled Gazprom has been quick to stress its readiness to continue transiting gas across Ukraine, including after 2024. However, new volumes for transit via Ukraine need to be settled "under market conditions and at market prices," Gazprom stressed, giving itself some leeway.

The statement was issued in response to US President Joe Biden's request that Germany should prevent Gazprom from cutting off supplies or gas transit through war-torn Ukraine.

"We always approached Nord Stream 2 as an economic project," the Gazprom CEO Alexey Miller said, pointing out the goal of the Russia-Germany interconnector "aims to reduce the cost of gas for end-consumers." In fact, the Baltic Sea link reaches Germany almost 2,000 kilometres ahead of the route traversing the gas transmission system of Ukraine.

Restricted flows

Though the German regulator BNetzA is likely to grant a license, it is expected to restrict the use of Nord Stream 2 in German waters to 50–80% of its full capacity to comply with third energy package rules on third-party access. Russian gas flows in the OPAL pipeline, running from Lubmin near Greifswald to Olbernhau near German-Czech border, had already been heavily restricted in 2009 and analysts assume both

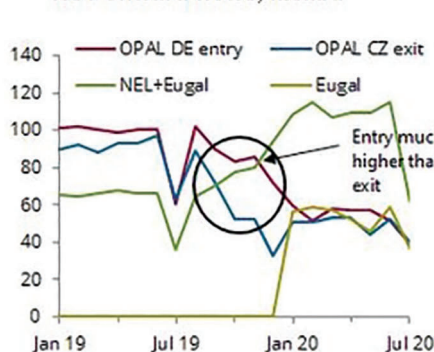
Nord Stream 2 and its onshore connection EUGAL will be restricted to 75% capacity for the foreseeable future.

Energy Aspects anticipates Gazprom will have to use under 5.8 bcm/y of EUGAL capacity, given that it appeared able to access all but 16% of OPAL in the fourth quarter of 2019, despite an official 50% restriction.

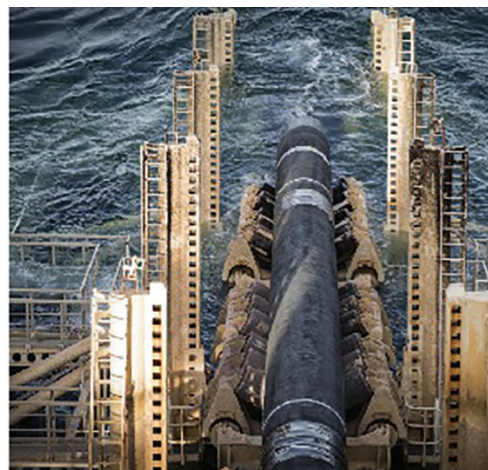
Before the start-up of the EUGAL pipeline in January 2020, Gazprom "appeared to book interruptible capacity at Greifswald and

then take the gas upstream of the Czech border," analysts said, suggesting the Russian gas giant would want to use this flow configuration again. "Assuming this residual Nord Stream 1 quantity is flowing through EUGAL at Nord Stream 2 start-up, the latter would only be able to flow at least at 89%," analysts said, though Gazprom's utilisation could be lower depending on the regulatory restrictions in a bid to open up the pipeline infrastructure to competing supply. ■

NS1 onward flows, mcm/d



Source: System operators, Energy Aspects



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Raised 'vulnerability score'

In April, Fitch raised its 'vulnerability scores' for 100 utilities in Europe, the Middle East and Asia (EMEA) for the period 2025-2050. Integrated utilities like Enel, Iberdrola and EDP score a moderate 15 points, while Engie and Naturgie score 30-35 points due to higher transition risk of gas-fired generation, compared to transmission and distribution (T&D) assets.

Electric utilities exposed to coal generation were assigned given a higher risk score given that they are mandated in most coun-

tries to transition to a low-carbon economy. Utilities often face the choice to either convert their coal power units to natural gas or shut them completely.

In contrast, companies focussed on gas T&D networks enjoy a relatively low and stable 'vulnerability score'. This is due to greater energy efficiency and the substitution of natural gas by other energy sources, such as renewables or district heating or heat pumps, which can reduce utilisation of gas infrastructure in the longer term. ■

Solid state battery market could top \$8 billion by 2031

Investment in solid state batteries surges with technologies close to mass production, and the overall market may well grow over \$8 billion by 2031, IDTechEx forecasts. Replacing liquid electrolytes with solid-state counterparts pushes the energy density beyond 1,000 Watt-hours per litre (Wh/L), while enhancing operational safety and durability.

High-end lithium-ion batteries can reach an energy density of over 700 Wh/L at cell level, with a maximum driving range of about 500 km for electric vehicles. That is significantly less than the first generation solid state batteries. Fire risk is another serious hazard, given that lithium-ion batteries use flammable and corrosive liquids IDTechEx said, noting that dozens of electric vehicle fire accidents have been caused by battery combustion.

Lithium-ion energy storage technologies typically employ liquid electrolytes, with lithium salts such as LiPF₆, LiBF₄, or LiClO₄ in an organic solvent. The decomposition of the electrolyte at the negative electrode causes a firm interface which limits conductivity and energy flows. Moreover, the size of lithium-ion batteries is limited because they need a membrane to separate the cathode and anode, as well as an impermeable casing to avoid leakage.

Solid electrolytes safer and long-lasting

By replacing organic liquid electrolytes with solid counterparts, the novel solid-state batteries are safer and long-lasting. Initially, early generations of solid-state batteries may have "similar or even less energy density than conventional lithium-ion batteries," analysts cautioned. But they were quick to add that "the energy available in the battery pack can be comparable or even higher than the latter."

With the larger electrochemical window that the solid electrolytes can provide, high

voltage cathode materials can be used. In addition, high-energy-density lithium metal anode can further push the energy density for beyond that of rival battery types.

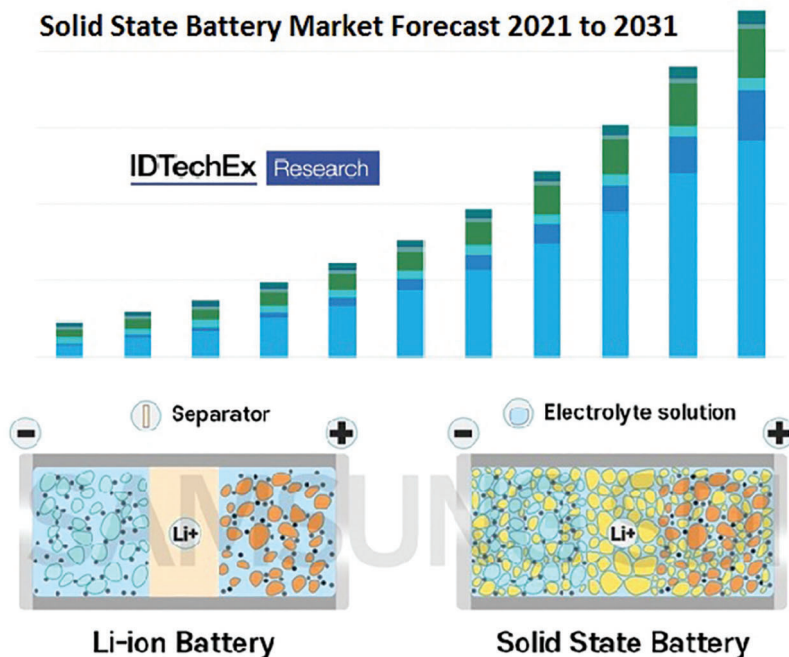
Evaluating range of polymer electrolytes

Various technology approaches are under development: IDTechEx has identified solid-state battery technologies including solid polymer electrolyte, as well as other 8 inorganic electrolyte types such as LISICON-like, argyrodites, garnet, NASICON-like, Perovskite, LiPON, Li-Hydride, and Li-Halide. In general, oxide, sulphide, and polymer systems have become popular options.

Sulphide electrolytes have advantages of high ionic conductivity, even better than liquid electrolytes, low processing temperature and a wide electrochemical stability window. However, analysts cautioned "the difficulty of manufacturing and the toxic by-product hydrogen sulfide generated in the process make the commercialization relatively slow."

Polymer systems are easy to fabricate, and they are closest to commercialization, while the relatively high operating temperature, low anti-oxide potential, and worse stability indicate challenges. Oxide systems are stable and safe, while the higher interface resistance and high processing temperature show some difficulties in general. ■

Solid State Battery Market Forecast 2021 to 2031



EDF and Wärtsilä activate 50 MW battery storage in Oxford

Pivot Power, part of EDF Renewables, together with Wärtsilä and Habi Energy have activated the UK's first grid-scale battery storage. Combining lithium-ion and



UK's first, 50 MW grid-scale battery storage

vanadium redox flow systems, the battery storage is directly grid-connected as part of the £41 million Energy Superhub Oxford (ESO) project aimed at decarbonising the city by 2040.

The 50MW lithium-ion battery energy storage system has been linked to National Grid's high-voltage transmission system at the Cowley substation on the outskirts of Oxford. Energy storage provides essential flexibility to cost-effectively integrate more renewables, and increase system resilience.

Backed by the British government, the

project integrates energy storage, electric vehicle charging, low carbon heating and smart energy management with a view to decarbonising Oxford and create a blueprint for other cities to reach net zero.

Pivot Power announced it deploy up to similar sites throughout the UK. "We are planning up to 40 similar sites throughout the country, totalling up to 2GW of battery storage – forming a key pillar of EDF's plan to develop an additional 10GW of battery storage globally by 2035," said Matt Allen, CEO of Pivot Power. ■

German coal exit likely to happen before 2038 due to CO2 price

Rising CO2 costs accelerate the coal exit in Germany. With the EU's carbon price trading above €56 per ton, a lignite power station in Chemnitz will be shut early and the conservative chancellor candidate Armin Laschet suggested North Rhine-Westphalia (NRW) "could manage [the coal exit] as early as 2030" – years before the mandatory exit date in 2038.

Laschet is state premier of NRW, Germany's most populous state and a key lignite mining region. Under the hard-fought coal exit law, Germany's total installed lignite-fired power generation capacity will be reduced to 15 gigawatts (GW) by the end of 2022, and then be cut to 8.8 GW between 2025 and 2029. But things may well go faster.

Over in Saxony, the municipal utility of Chemnitz already announced to shut down its brown coal power stations six years earlier than planned, in 2023, citing a "price explosion" in the European emission trading scheme (EU-ETS). Three of five blocks of the Chemnitz combined heat and power plant (CHP) are already closed, and the remaining two will be gradually replaced by a gas-fired unit starting from 2022.

Payments for early closure

According to Germany's coal exit law, the last lignite fired power station has to be discontinued by 2038. While there is a set phase-out time table for large lignite plants, hard coal stations and small lignite units can participate in auctions for receiving payment in return for closing down. This incentivises an early exit.

However, the German government has come under pressure for compensation payments agreed with large lignite operators RWE and LEAG for closing their plants. These payments are currently scrutinised by the European Commission as to whether they are in line with EU State aid rules.

Analysts warned that Germany may miss its new Net Zero emissions target by 2045 if energy-related emissions cannot be reduced quicker. At the same time, emissions from transportation and industry remain stubbornly high.

Fresh debate about end-date

In light of the catastrophic floods that hit Germany, Bavarian state premier Markus Söder (CSU) had reiterated calls for an earlier exit and said the end-date should be renegotiated. In contrast, NRW's head of state Laschet wants to stick to the coal commission agreement but let markets determine the final end date.

In a hard-fought compromise, Berlin in 2020 agreed a landmark €40 billion deal to phase out coal and investing offshore wind, solar power and new long-distance power transmission lines. The agreed phase-out roadmap entails a boost for renewables to

reach a 65% share in power consumption by 2030 in order to compensate for the closure of coal power plants. It will also seek to expand combined heat and power (CHP) systems and install "two gas plant capacities" to cushion "the vanishing of large quantities of controllable energy." ■

NEWS NUDGES

Slow LNG uptake in Africa

In Africa, the uptake of LNG imports to new markets has been slow. Both Ghana's 1.7 million tons per annum (mtpa) Tema LNG terminal and Senegal's 1.0 mtpa Dakar Powership are still awaiting their first LNG deliveries, though their respective FSRUs Vasant and Karmol's Powership Africa have been in place since June.

US oil exports stay high

Despite volatile prices, U.S. crude oil exports reached a record high in 2020 and remained strong this year, averaging 3.51 million barrels per day (b/d). Expanded ports at Houston and Corpus Christi allow for oil to be exported from the Permian Basin and Eagle Ford Basin.



RWE's open-cast lignite mining in Garzweiler, North-Rhine Westphalia

Rolls-Royce sets out roadmap for 'Net Zero Power Systems' by 2030

By 2030, Rolls-Royce Power System seeks to cut its greenhouse gas emissions by 35% compared to 2019-level through the use of more zero carbon technologies. MTU engines will be certified to run on sustainable fuels from 2023, and the manufacturer also works on CO₂-free fuel cells for balancing power.

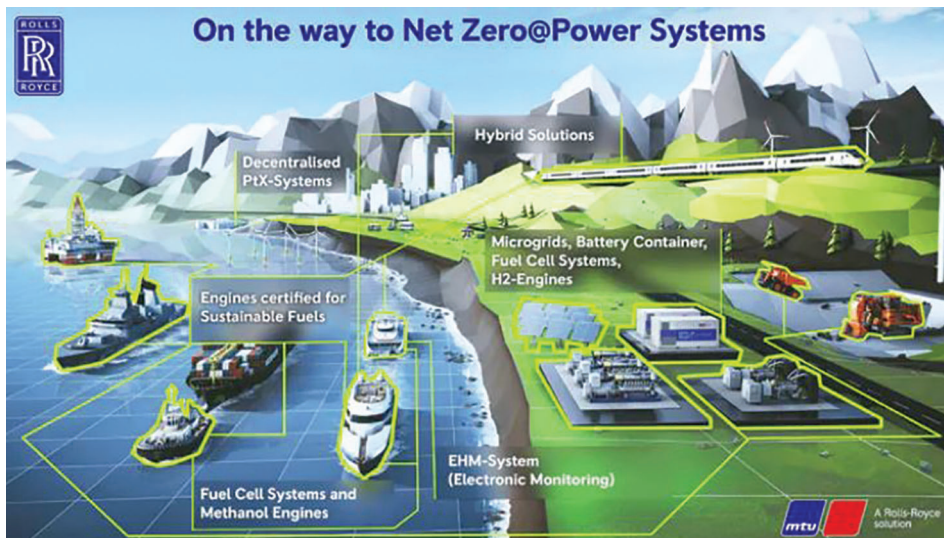
“The new Series 2000 and 4000 engines, that make up 85% of our sales revenues, will be qualified to run on second-generation bio-fuels and on E-fuels,” explained Dr Otto Preiss, Chief Technology Officer of Rolls-Royce Power Systems. The engines can be used for power generation, commercial shipping, heavy land vehicles,

passenger trains and in yachts.

Taking a multi-pillar approach to reducing emissions, Rolls Royce is not only working on co-firing sustainable fuels in its MTU engines, but is also developing carbon free fuel cells. From 2025, these will be used in power generation solutions – from balancing energy for compensating fluctuations in the public grid to continuous power and the

provision of emergency power in, for example, hospitals and data centers.

On top of that, development engineers are also working on engines powered by hydrogen and methanol as well as on concepts for decentralized Power-to-X systems. Battery energy storage, hybrid propulsion systems for marine and rail applications and microgrids are already on offer.



Green growth opportunities

In total, the Power Systems products sold in 2019, the year before the pandemic, will generate some 109 million tons of greenhouse gases over their service life – almost double that emitted by the Greater London region every year. “That means that when it comes to lowering emissions, we have a lot of leverage,” CEO Andreas Schell admitted.

Vying for green growth and profits, he noted: “With ‘Net Zero at Power Systems’, we are not just taking action to protect the environment. We’re re-aligning our strategy towards eco-friendly energy and propulsion systems. We already see these explicitly as growth opportunities for our business in the coming years.”

Tapping smart meter data 'vital' for e-vehicle rollout – Innowatts says

Britain's latest 'Innovation Strategy' incentivises power generators and distributor to invest into analysing consumers' demand patterns. If billions of meter level interval data produced daily by UK smart meters remains untapped, it will be hard to integrate electric vehicles, offshore wind and energy storage, Innowatts CTO David Boundy warned.

By launching the Innovation Strategy, the UK government underlined its commitment of ensuring businesses across digital, data, energy and utilities have the right infrastructure to innovate and grow. Though the government pledge to increase R&D investment to £22 billion, additional private sector investment will have to come forward to digitalize the energy sector.

pected to have over 25 million smart meters producing billions of bits of data an hour. However, to date, much of this data has remained untapped. We're here to change that,” Boundy said.

Analysing demand data gives electricity suppliers more control, choice and flexibility. They can pinpoint hotspots for electric vehicle

use or identify trends for time-of-use tariffs.

The Houston, Texas-based company has operated in Europe since 2019 and sees “enormous potential” for electricity suppliers and grid operators to gain insights into data about consumers' demand patterns to make informed decisions about renewable integration and energy storage.

SaaS analyses billions of data points

Innowatts' Core Analytics module uses meter data to segment consumption by weather, time, and base-load criteria. The company's SaaS platform for energy providers can analyse over five billion data points every hour, helping utilities with load forecasting and grid edge management.

“By summer 2021, the UK alone is ex-



Keppel's Floating Living Lab gets Wärtsilä's hydrogen-ready engines

Two Wärtsilä engines, running on hydrogen blends, will back up the electricity supply at Keppel Offshore & Marine so-called 'Floating Living Lab (FLL)', the first offshore floating testbed for LNG bunkering, power generation and energy storage. Keppel's floating LNG bunkering units need an uninterrupted supply of electricity, ensured by the two Wärtsilä 34SG engines.

Continuous electricity supply is vital for Keppel's floating LNG bunkering facilities, used as a testbed for how best cut carbon emissions for marine vessels by blending hydrogen into LNG. Under Keppel's Vision 2030, the company is looking into new energy carries. "We are looking for future-proof solutions and engines with

overall efficiency and capability for burning hydrogen was an important consideration in the award of this contract," said the company's director new builds, Tan Leong Peng.

Engines to burn up to 25% hydrogen

The floating power gensets, based on 34G

engines, will run on natural gas/LNG blended with up to 3% hydrogen, though modifications can utilise up to 25% hydrogen. The engines are scheduled for delivery in the third quarter of 2021, Wärtsilä specified with a view to getting the power gensets fully operational by the first quarter of 2022.

"The Wärtsilä generating sets will use the boil-off gas from the LNG process for power generation, and will be running in parallel with the grid, energy storage, and solar energy," explained the manufacturer's energy business director, north & south east Asia, Nicolas Leong.

Wärtsilä and Keppel O&M have partnered in several marine projects. ■



Render of Keppel's Floating Living Lab

JERA invests in hydrogen combustion at Linden Gas Power Unit 6

Japan's largest LNG importer and power generator JERA has invested in the operator of the 972 MW Linden Gas Thermal Power Station which is fuelled by gas containing hydrogen. Phillips 66 is supplying the hydrogen/natural gas mix to the Power Unit 6 from its nearby Bayway Oil Refinery in New Jersey.

The turbine at Linden Unit 6 will be modified so that refinery produced fuel gas containing hydrogen, can be co-fired with natural gas. Following the upgrade in 2022, Unit 6 will be able to combust up to 40% hydrogen which helps curb CO2 emissions by around 10%.

To co-fire Japanese power plants with hydrogen will take some time, JERA cautioned, because this will require the development of carrier technology. The Japanese major hence first seeks to resolve technical issues

with hydrogen combustion at power plants in the United States, where hydrogen is available. This expertise will then be applied to future projects at home in Japan and overseas. ■



Linden Gas Thermal Power Station in New Jersey

INNIO Jenbacher gas engines ready for hydrogen

Jenbacher Type 4 gas engines are now available as 'Ready for H2' engines, able to operate on up to 100% hydrogen. All other INNIO engine types can run on up to 25% hydrogen in pipeline gas and most currently installed Jenbacher gas engines can be converted to full hydrogen combustion.

The 'Ready for H2' engines include INNIO's product portfolio in the 200 kW – 10.4 MW power generation space. Fuel flexible Jenbacher gas engines can run on natural gas, carbon neutral biogas or hydrogen-rich fuels.

"Jenbacher gas engines running on natural gas today can be converted to H2 operation when hydrogen becomes more readily available," explained Carlos Lange, president and CEO of INNIO. "This means that customers who invest in Jenbacher natural gas engines today, are also investing for the future."

With about 90 hydrogen-rich fuel projects across 28 countries, Jenbacher engines are already operating on up to 70% volume of hydrogen in the fuel, yielding more than 250 MW. These installations can be found on all continents with various INNIO Jenbacher Type 2, Type 3, Type 4 and Type 6 gas engines. ■

Ansaldo deploys world's first MXL3 upgrade at ENGIE-operated plant

Maxima-Flevo, a combined cycle plant owned by the French utility ENGIE, will get the world's first MXL3 turbine upgrade by Ansaldo Energia in spring 2023. The current output of power unit-5 will be boosted by up to 35 MW, driven by the first F-class turbine in Europe to reach over 60% efficiency.

Featuring latest H-class technology, the upgrade makes the turbine over 1.5% more efficient and extends the maintenance interval to 40,000 Equivalent Operating Hours – same as for the established MXL2 Upgrade. The higher

efficiency could help save up to 40,000 tons of CO₂ per year, depending on the running profile.

The revamped turbine can switch between 'performance' optimized mode and 'maintenance cost' optimized mode de-

pending on the market requirements. According to Ansaldo, it will have a "best-in-class turndown ratio," high availability as well as extensive operational flexibility.

"By acting as launch customer for the introduction of the MXL3 upgrade at Maxima-Flevo power plant, ENGIE continues to be a first mover in the market," said Cedric Osterrieth, chief executive of ENGIE GENERATION Europe.



Maxima-Flevo CCGT near Lelystad, Netherland

Hydrogen-ready turbine

The MXL3 technology facilitates fuel flexibility and allows the co-firing of hydrogen up to 45% of volume flow, with no additional changes to the gas turbine hardware. Raising the hydrogen share of the overall fuel helps to further reduce emissions during the combustion process.

ENGIE is committed to reach Net Zero carbon emissions by 2024 and is hence considering to applying Ansaldo MXL3 technology to all GT26 turbines of its European fleet. ■

GE's HA gas turbine sold to 50 customers, generates over 26 GW

General Electric's H-class gas turbine has reached a milestone of accumulating more than 1,000,000 commercial operating hours. The heavy duty turbine was ordered by 50 customers to date and generated more than 26 GW of electricity.

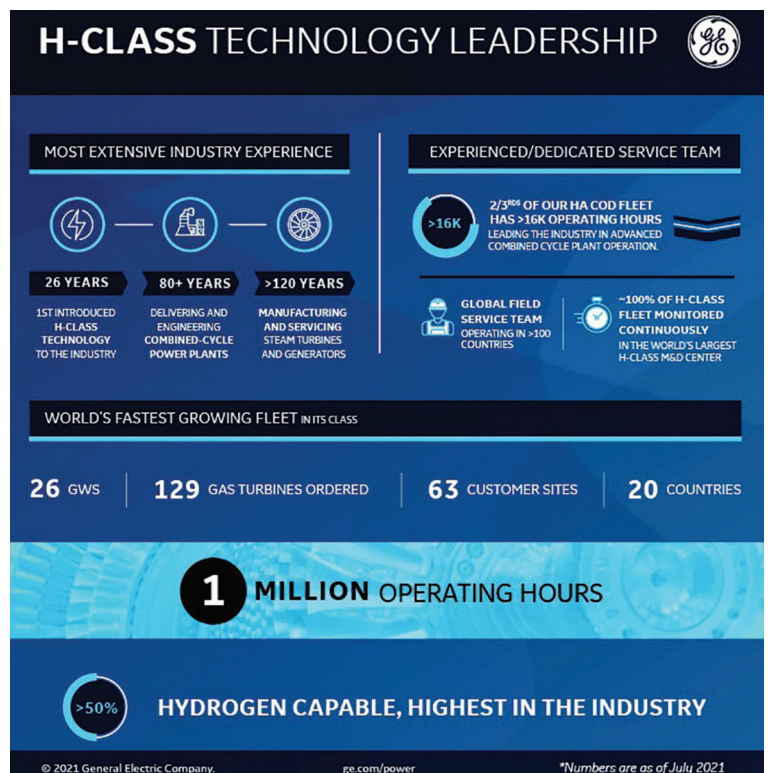
Since its launch in 2014, GE's flagship turbine set a new record for combined-cycle efficiency in 2016 at the Bouchain power plant in France. The EDF-operated plant reached a verified efficiency of 62.22%.

In 2021, Southern Power Generation's 1.4-GW Track4A gas power plant in southern Malaysia, running on the first commercial GE 9HA.02 gas turbines, was named "Power Plant of the World" for "a meaningful model for balancing climate awareness, energy affordability, and reliability in power-hungry Southeast Asia." In addition, the role of GE's HA technology adopted at China Huadian Corp's Juliangcheng plant was recognized for its accelerating role to retire existing coal-fired capacity and replace it with new, high efficiency combined cycle.

HA-powered by hydrogen

Looking ahead, GE just started HA-powered pilot projects focused on demonstrating power plants capable of operating on hydrogen. The manufacturer's range of H-Class turbines can burn up to 50% by volume of hydrogen when blended with natural gas. This works thanks to the DLN2.6e combustion system which is part of 9HA.01, 9HA.02 and 7HA.03 gas turbines offerings.

Hydrogen is not the only path for decarbonising gas turbines. GE's H-class combined cycle power plant can also be configured with a post-combustion capture system to reduce CO₂ emissions by up to 90%. Green energy is becoming a key sales factor. ■





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