



Weekly News

3 December 2021

Gazprom's 2022 budget prioritises fields feeding export to China

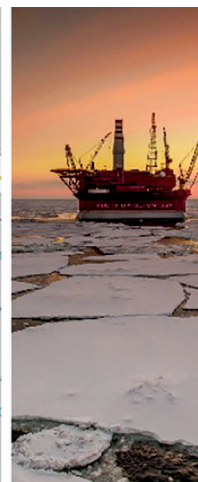
Gazprom's management has endorsed the 2022 investment budget of 1,757.69 billion Roubles (US\$23.70bn), including 1,427 billion Roubles for capital investments, while borrowings amounts to over 272 billion Roubles. Top priority projects include new gas production centres at Yamal, Yakutia and Irkutsk well as upgrades of the Power of Siberia gas trunkline to boost exports to China.

"Debt financing plans under the Borrowing Program will be made on the basis of the market conditions, liquidity and Gazprom's financing needs," the Russian state-dominated company underlined.

Cost reduction measures have been front and centre over the past two years after the Covid-19 pandemic had led to an initial step drop in oil and gas consumption worldwide.

Exporting more Siberian gas to China

China's swift recovery from the pandemic and economic rebound has caused a substantial rise in Russian gas imports. Since March,



Gazprom has ramped up output at the Chayandinskoye field in Yakutia, eastern Russia, – one of the key supply sources for gas exports to China.

Daily volume of natural gas produced from the Chayandinskoye field and supplied into the Power of Siberia trunkline have grown 2.9-fold within a year's time. Production at the field has now entered Phase-2 with Gazprom preparing to put a pre-treatment unit No. 2, a membrane unit for helium concentrate extraction and 34 pads of gas well clusters into operation.

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Snam buy stakes in Algerian gas pipeline in bid to import hydrogen

Italy's TSO Snam Rete Gas has acquired a stake in pipelines carrying Algerian gas to Italy in a bid to accelerate hydrogen imports to Europe. Snam agreed to pay Eni €385 million for a 49.4% stake in the pipelines that could soon carry green hydrogen from Algeria to fuel Italian power stations and help decarbonise heavy industry.

Like other European gas grid operators, the Italian TSO Snam Rete Gas is investing considerable amounts to upgrade its national network to be 'hydrogen ready'. Snam already owns 20% of the TAP pipeline that imports natural gas from Azerbaijan via Eastern Europe to Italy.

Accelerating use of hydrogen in power gen and transport

"In the future, North Africa could also become a hub for producing solar energy and green hydrogen," said Snam CEO Marco Alvera in a joint statement with Eni. The acquisition reflects Snam's



commitment to accelerate the pace of importing hydrogen to Italy to decarbonise industry, transport and power generation.

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Unique helium separation process

The gas and condensate production process is carried out and controlled remotely, where by the helium is extracted through nanotechnologies. Natural gas flows through the membranes, installed at the facility, in stages and helium concentrate is extracted as a result of this. In the process, dry gas feedstock is separated

into commercial-grade gas with 0.05% helium content which is then sent to the Amur Gas Processing Plant via Power of Siberia, while the helium-enriched (9.75%) gas passes through other stages until the helium content increases to about 37%.

Gazprom claims its patented membrane gas separation method of helium extraction

is "unique and innovative" for the industry all over the world. "Helium has never been extracted from natural gas via industrial-scale use of a two-stage membrane unit before," Igor Krutikov, Director General of Gazprom Dobrycha Noyabrsk said, underlining; "This method provides for a rational utilization of helium as a strategic resource." ■

Gazprom's profits surge amid rising prices and exports

Gazprom has returned to a nine-month profit of 1,579.94 million Roubles (US\$21.31m), up nearly fivefold from the 2020 period as the world's recovery from the pandemic caused an 18% jump in Russian gas exports to Europe and Asia, while prices more than doubled. The profit surge reversed Gazprom's 2020 loss of 202,21 million Roubles.

Net gas sales to Europe increased by RUB 1,325,694 million, or 117 %, to RUB 2,460,824 million – mainly due to a 95% surge in prices denominated in Russian Roubles and a 14% increase, or 21.3 bcm rise, in gas volumes sold over the first nine months this year. Average gas prices denominated in US Dollar increased by 87% over the same period of time.

Net gas sales to Former Soviet Union countries rose by 34% and sales within Russia were up 18% over the same period.

Crude oil and gas condensate sales surge surged 81% to 622,682 million Roubles, mainly due to the rise in global oil prices. Meanwhile, sales of refined products were up 43% to 1,858,231 million Roubles due to a rising average prices in all of Gazprom's export markets.

Debt down due to "increase in cash"

Adjusted EBITDA increased by 1,278,451 million Roubles, or 137% for the first nine

month of 2021 and amounted to 2,213,614 million Roubles. "This change was mainly due to an increase in sales," Gazprom noted.

The company's net debt balance fell 10% from 3,872,695 million Roubles as of December 31, 2020 to 3,484,571 million Roubles as of September 30, 2021 – "mainly due to an increase in cash and cash equivalents".

Operating costs up a third

On the cost side, Gazprom reported a 32% increase in operating expenses to 5,202,452 million Roubles, mainly due to rising cost for

so-called "Purchased gas and oil," the company said.

Taxes other than on profit were up 22% due to rising expenses for mineral extraction taxes which, according to Gazprom, was partially compensated by a decrease in excise tax expenses. "The greater mineral extraction tax expenses were mainly caused by an increase in crude oil prices, tax rate as a result of the tax manoeuvre and a rise in volumes of gas production," the company said in its nine-month earnings statement. ■



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Hydrogen-cofiring is top of the agenda for many power producers as most turbine operators are striving to get their machinery hydrogen-ready. The aim is to convert gas-fired turbines to run fully on hydrogen in the near future, eliminating emissions during the combustion process.

Eni seeks to reduce debt, shift to cleaner fuels

Eni, for its part, is preparing to spin off several of its oil and gas operations into new joint

ventures in an effort to reduce debt and fund its strategic shift towards low-carbon energy. "The transaction with Snam allows us to free up new resources to be used on our energy transition path," Eni CEO Descalzi said.

Italy's national oil company Eni is one of the biggest foreign oil and gas producers in Africa and has a series of long-term import agreements with Algeria's state-owned Sonatrach. Italy covers over 90% of its gas needs via imports and Algerian gas accounts for 30% of these volumes. ■

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Hydrogen to become South Korea's biggest energy source by 2050

The government of South Korea is working towards turning hydrogen into the country's biggest energy source by 2050 by expanding H₂-based power generation, and replacing all fossil fuel used by the steel and chemical industries with blue or green hydrogen. To tackle transport emissions, over 2,000 hydrogen charging stations will be installed nationwide.

The government's new plan stipulates 15 projects for producing clean hydrogen in South Korea, expanding the country's hydrogen storage and transmission infrastructure and to enhance the use of hydrogen by industries and the transport sector.

The explicit aim is to supply 27.9 million tons of hydrogen by 2050 – partly blue and green hydrogen. Blue hydrogen is made through natural gas reforming with subsequent carbon capture, while green hydrogen is produced from renewable energy sources via electrolysis.

Scaling up green hydrogen to curb costs

By scaling up green hydrogen production facilities, South Korea seeks to lower the costs of production. According to the government's plan, 250,000 tons of green hydrogen is intended to be produced and the cost per kilogram is meant to be lowered to 3,500 won in 2030. Thereafter, green hydrogen output will be raised to three million tons while lowering production costs to just 2,500 won by 2050.

At the same time, the volume of blue hydrogen production will be boosted to 750,000 tons by 2030, and increased further to 2 million ton by and 2050 – accompanied by carbon storages for at least 900 million tons.

In addition to producing hydrogen at

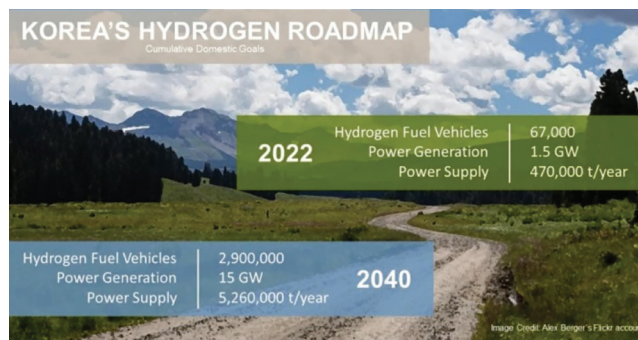
home, South Korea is also striving to source and import the zero-emissions fuel from a growing number of countries overseas. The aim is increase the number of its hydrogen supply chains to at least 40 by 2050.

Ports to import hydrogen will be build adjacent to LNG-fuelled power plants whose turbines can be co-fired with hydrogen. A growing number of coal-fired power station will also be converted run on to natural gas and hydrogen in an effort to reduce power sector emissions and reduce Korea's chronic air pollution.

Aiming for 24% hydrogen in Korean power mix

As for hydrogen-based power generation, the government calls on utilities to expand mixed combustion and revamp plants with new H₂-ready gas turbines so that the amount of that type of power generation can be boosted from 3.5 Terrwatt-hours (TWh) in 2020 to nearly 288 TWh in 2050.

"Hydrogen will account for 33% and 23.8% of South Korea's energy consumption and power generation in 2050, respectively. Then, hydrogen will become its biggest energy source by beating petroleum and the economic effects of this include



567,000 new jobs and at least 200 million tons of greenhouse gas reduction," the government's plan reads.

Making households buy H₂-fuelled cars

Looking at the hard-to-abate transport sector, South Korea aims to increase the capacity of H₂-ready vehicles to 5.26 million units by 2050. In addition, hydrogen will be applied to various means of transport, including ships, drones and trams. Fuel cost and purchase subsidies for commercial hydrogen vehicles will be raise to incentivise private households to shift to H₂-ready cars.

To fuel these cars, the government aims to at least one build at least hydrogen charging station in each of South Korea's 226 cities, counties and districts by 2025 and facilitate access to hydrogen charging stations within 15 minutes of each home nationwide by 2040.

Hyundai Heavy to import LPG from Aramco to produce blue hydrogen

South Korea's Hyundai Heavy's refining unit Hyundai Oilbank has agreed to import liquefied petroleum gas (LPG) from Saudi Aramco to produce blue hydrogen, made through steam methane reforming with subsequent carbon capture. This blue H₂ will be sold as a fuel to Korean power generators.

The heads of Hyundai Heavy and Aramco, Chung Ki-Sun and Ahmad Al-Sa'adi, signed a Memorandum of Under-

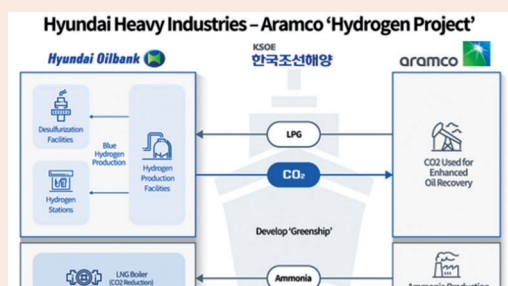
standing (MoU) that will see the two majors set up a series of businesses to use hydrogen and ammonia – a compound of hydrogen and nitrogen that can be burnt without CO₂ emissions.

As a first step, Hyundai Heavy will import pre-defined volumes of LPG from Aramco to produce blue hydrogen – in turn Hyundai Oilbank will supply CO₂ generated in the production process to Aramco to be utilized for enhanced oil recovery (EOR) in Saudi oil fields. EOR is a practise of inserting CO₂ in depleted oil and gas fields to boost the pressure in the underground caverns in order to boost the extraction ratio of the remaining hydrocarbon stock. The injected CO₂ remains permanently stored underground.

Second, Hyundai Heavy and Aramco agreed to develop ammonia-fuelled ships as well as specially designed vessels that can transport ammonia, LPG as well as CO₂. To that end, Hyundai will call on its shipbuilding arm KSOE which has been task with designing and building these two special types of vessels.

On the downstream side of the hydrogen supply chain, Hyundai Oilbank has committed to set up 300 hydrogen fuelling stations across South Korea by 2040. This is in line with the government's latest strategy to significantly step up the domestic production and use of green fuels.

Aramco also committed to produce blue ammonia to fuel Hyundai Oilbanks LNG boiler which is meant to be established as a pilot project by 2024.



Gazprom to develop grey hydrogen projects in Russia, eyes exports to EU

Russia's state-controlled Gazprom plans to develop and implement a series of natural gas-based hydrogen projects in a bid to decarbonise industry and transport. A draft roadmap has been submitted to the government for approval, Gazprom said whose group enterprises currently produce over 350,000 tons of hydrogen and hydrogen-containing gas per year.

In mid-October, the Russian Government and Gazprom signed an Agreement of Intent aimed at advancing the development of hydrogen energy on the basis of natural gas. This so-called grey hydrogen is cheaper to produce than green hydrogen produced through electrolysis using only renewable power sources.

Gazprom underlined it approaches hydrogen "both as a means to reduce the carbon footprint of natural gas supplies and as a commercial product." To this end, Gazprom Hydrogen has been launched as a special-purpose company, which will devise integrated solutions in the area of natural gas-based hydrogen technologies.

Grey hydrogen exports – a new revenue stream

Gas steam reforming could become a life-line for Gazprom if it manages to convince the EU to adopt a "technologically neutral approach to hydrogen." Grey hydrogen currently costs \$1–1.80 per kilogram to produce, which is far cheaper than the \$2.50–6.80/kg for green hydrogen.

The Russian gas major currently produces over 350,000 tons of hydrogen by various technologies, mostly from natural gas steam reforming. Hereby, methane reacts with steam under 3–25 bar pressure in the presence of a catalyst to produce hydrogen, carbon monoxide, and some small amount of CO₂ which can be captured.

The Russian Academy of Sciences (RAS) strives to solve technical challenges in producing grey hydrogen through steam reforming in the most cost-efficient way. If scientist manage to bring the costs down below \$1/kg, the Russian-made grey hydrogen likely become an attractive fuel for exports – both to Europe and China. To that end, RAS is not only looking for technology improvement in steam reforming but also at was to transport the fuel to end-users. The findings of the studies will be factored into Gazprom's sustainable development scenarios up to 2050.

EU urged to not favour green over grey hydrogen

Over the past month, Gazprom has been lobbying the European Union to cover its hydrogen demand in a "technologically neutral" way and focus on total CO₂ emissions instead of prioritising green hydrogen, produced through electrolysis with renewable energy.

Germany, the biggest buyer of Russian gas in the world, is embracing hydrogen to reduce the carbon footprint of energy-intensive industries, transportation and power generation. The government in Berlin expects that around 90 to 110 TWh of hydrogen will be needed by 2030. To cover part of this demand, policy makers support up to 5 GW new-built green hydrogen production capacity – but the lion's share will need to be imported, partly as grey hydrogen. ■

NEWS NUDGES

SLNG and Linde Gas to develop CO₂ liquefaction unit

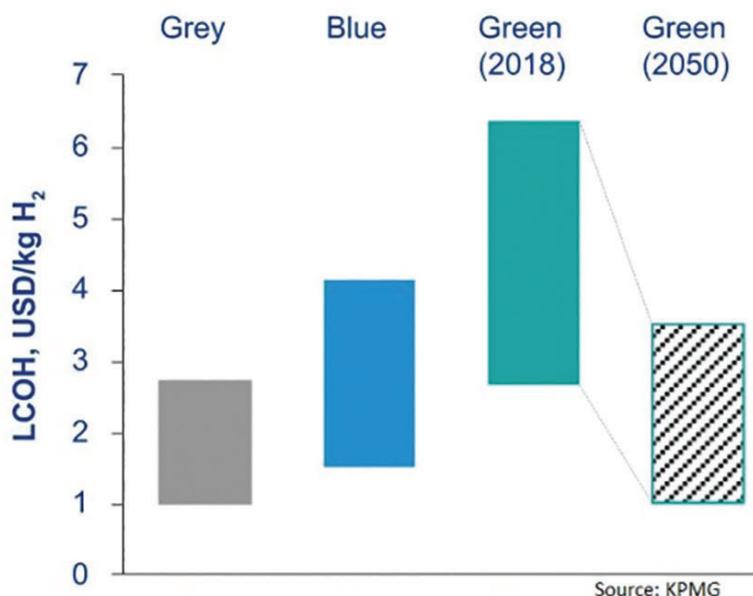
Singapore LNG (SLNG) and Linde Gas have teamed up to develop a carbon dioxide liquefaction and storage facility. A feasibility study is underway to build a CO₂ liquefaction unit next to the SLNG Terminal on Jurong Island. SLNG chief executive Tan Soo Koong said the company's objective is cold energy recovery with high efficiency, as well as effective liquefaction and storage to reduce CO₂ emissions.

Oseberg upstream shifts from oil to gas

Equinor has announced plans to invest 10 billion Norwegian crowns (\$995M) to change the Oseberg field from primarily being an oil field to becoming a substantial natural gas producer with large remaining gas resources. Oseberg is the third-largest oil producing field on the Norwegian Continental Shelf, and the operator has submitted and amended development plan to the energy ministry.

ABB, Metacon and Wärtsilä partner on hydrogen

ABB, Wärtsilä, Metacon affiliate Helbio, and the classification society RINA are jointly working on delivering a power solution for marine application that is fuelled by hydrogen. The aim is to have a scalable solution that will exceed the IMO 2050 target for a 70% reduction in carbon intensity without the need for extensive investment in new infrastructure. Wärtsilä gas engines can already run on a mix of hydrogen and LNG, and the company strives run them 100% on hydrogen fuel in the near future. ■



EGA and GE work on hydrogen-ready gas turbine as well as CCUS

Emirates Global Aluminium (EGA) and GE Gas Power have agreed to develop a roadmap to reduce emissions from EGA's operating fleet of gas turbines by turning to hydrogen as well as carbon capture, utilisation, and storage solutions (CCUS). The aim is to retrofit EGA's turbines to partially run on clean hydrogen and capture most gas-based emissions.

To this end, EGA chief executive Abdunnasser bin Kalban and his counterpart at GE Gas Power Europe, Middle East and Africa, Joseph Anis signed a Memorandum of Understanding (MoU) in the United Arab Emirates on Sunday. EGA operates aluminium smelters in Abu Dhabi and Dubai, an aluminium refinery in Abu Dhabi and a bauxite mine with related export facilities in Guinea – all powered by onsite generating units.

Already today, GE's H-class, F-class, B/E-class and aeroderivative gas turbines can run on different levels of hydrogen, though engineers caution that actual hydrogen levels may vary based on the gas turbine model, combustion model, combustion system, and overall fuel consumption.

Pilot project in New South Wales

In Australia, GE will supply a hydrogen-ready 50-Hz F-class gas turbine the 316 MA Tallawarra B Power Station, operated by CLP Group affiliate Energy Australia in New South Wales. The Tallawarra B project is backed by A\$83 million (US\$58.92m) in funding from NSW state and Australia's federal governments.

The open-cycle hydrogen and gas-capable

"peaking plant" is scheduled to start operation in time for the summer of 2023-24, following the anticipated closure of the large coal-fired Liddell power station, GE said.

Stiff competition from rival OEM

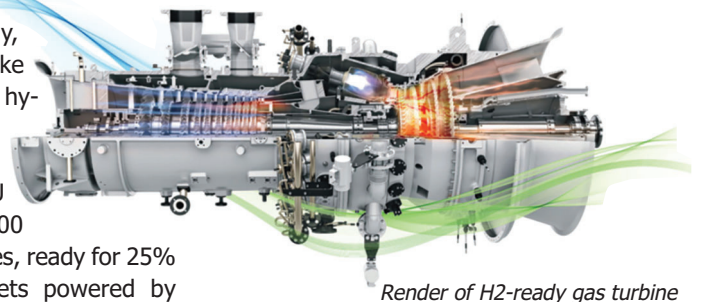
However, when it comes to co-firing gas turbines with hydrogen and ammonia, GE is facing stiff competition from rival original equipment manufacturers (OEMs). All large manufacturers are busy working to get their turbines hydrogen-ready, and many have already achieved running their equipment on 25% hydrogen or more.

MAN Energy Solutions, for instance, announced today it aims to offer hydrogen-fired engines to power station operators from 2025, and also strive to operate engines on ammonia and methanol by the end of 2022. Already today, some of MAN's four-stroke engines can run on a 25% hydrogen-blend in the natural gas mix.

Rolls-Royce affiliate MTU earlier launched Series 500 and Series 4000 gas engines, ready for 25% hydrogen co-firing. Gensets powered by

MTU Series 500 and Series 4000 gas engines can be operated with a gas blending of 10% hydrogen and starting from 2022, operation with 25% hydrogen content is meant to be possible, the company said, adding that conversion kits for 100% hydrogen operation will be available from 2025.

The Austrian manufacturer INNIO, meanwhile, recently commissioned its first engine in the 1 MW-range that runs on a variety of hydrogen-natural gas mixtures, or on 100% green hydrogen. This full hydrogen-ready power plant built on behalf of HanseWerk Natur in Hamburg. The combined heat and power (CHP) plant, commissioned in 2018, achieves a total electrical output of 8.4 MW and supplies heat and hot water to 500 residential buildings and businesses. ■



Render of H2-ready gas turbine

MAN upgrades four-stroke engines to run on hydrogen

MAN Energy Solutions works to upgrade its four-stroke engines to run on power-to-X fuels such as synthetic natural gas (SNG) and hydrogen. The Augsburg-based company aims to offer hydrogen-fired engines to power stations from 2025, and engines are also meant to run ammonia and methanol by the end of 2022.

Customers of MAN's power generation equipment will soon be able to use so-called 'future fuels' – notably ammonia, methanol and hydrogen. Though these fuels are currently not readily available on the market, their use in MAN units will be made possible through the incipient

start-up of green-fuel production facilities.

Aim to run engines fully on hydrogen by 2025

Already today, MAN's 35/44G TS, 51/60G and 51/60G TS gas engines relevant for use in power stations are already 'H2-ready' and can be operated with a hydrogen proportion of up to 25% by volume in the gas mixture.

By 2025, the units should also be updated and capable of operation on 100% hydrogen.

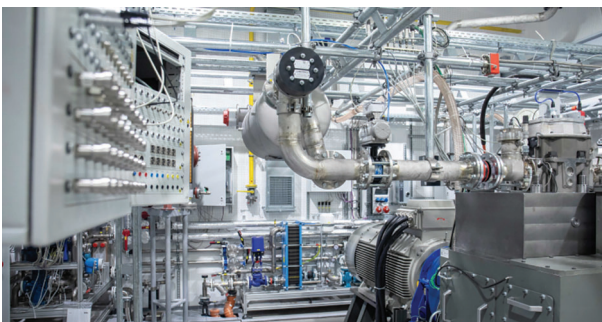
The 51/60DF and 51/60DF TS multi-fuel engines' CO2 emissions can be additionally reduced through the use of bio-fuels. "Full operation with bio-fuels has already been tested in the field and is possible without

any problems," said Alexander Stöckler, Head of the Power Plant Division at MAN Energy Solutions.

Study on ammonia co-firing underway

Similarly, MAN engineers are preparing grounds for operation on ammonia and methanol by the end of 2022.

"We are currently working on a realization concept for operation on ammonia and methanol and are confident that we will begin to implement this by the end of 2022," Stöckler said. "As of yet, neither fuel plays a role in energy generation but they may have significant potential for the future. Therefore, we are observing the situation very keenly and are in close communication with our customers. As soon as our customers are ready, our engines will be too." ■



MAN optimizes the combustion hydrogen, ammonia and methanol at its test center in Dessau-Roßlau.



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UK BESS fund secures £380m loan to finalise seven projects in 2022

London-based sustainable energy specialist Gresham House Energy Storage Fund (GRID) has secured a £380 million bespoke funding package from NatWest to support its UK energy storage pipeline. The funds will help ensure seven newly announced BESS projects can be completed in 2022.

Agreed over a five-year period, the funding comprises a £150 million capex term loan, £30 million working capital facility and £200 million uncommitted accordion. Part of the funds will also be used to repay a maturing bond.

"Introducing a modest amount of cost-effective leverage to the portfolio has been an ambition since IPO and we're delighted with the successful completion of this transaction, the terms achieved and the quality of the institutions that have taken part," said Gresham House Energy Storage Fund manager, Ben Guest.

Helping UK boost storage capacity 10-fold

GRID plans to substantially increase its portfolio size over the next two years, given the UK's need to increase battery storage capacity tenfold by the middle of this decade.

"This [loan] facility will provide us with the financial headroom to achieve our growth plans," Guest commented.

Considering the intermittent nature of wind and solar output, there is a growing need to deploy battery energy storage systems to ensure security of supply while decarbonising the UK's energy system.

"As the proportion of energy that comes from renewable sources grows, so does the importance of storage. This makes the work that GRID and the team at Gresham House do central to the net zero transition, and



Gresham battery storage units

NatWest are delighted to have supported them in this," said NatWest's specialist for energy asset finance, Jacob Lloyd.

Advisory support and legal counsel provided by Jefferies and Latham & Watkins. Additional funding provided by Santander, Lloyds Bank and Commonwealth Bank of Australia. ■



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World's fastest all-electric aircraft reaches nearly 556 km/h top speed

'Spirit of Innovation', developed by Rolls-Royce, is claimed to be "the world's fastest all-electric aircraft" with a top speed of 555.9 km/h (345.4 mph) over 3 kilometres. Electric flight, if adopted at scale, can help significantly decarbonise the aviation sector and Rolls-Royce says all its new products will be compatible with net zero operation by 2030.

According to data submitted to the Fédération Aéronautique Internationale (FAI), the aircraft reached achieved 532.1km/h (330 mph) over 15 kilometres – 292.8km/h (182mph) faster than the previous record – and broke the fastest time to climb to 3000 metres by 60 seconds with a time of 202 seconds.

Power-dense propulsion battery

The aircraft was propelled on its runs by a 400kW (500+hp) electric powertrain and the most power-dense propulsion battery pack ever assembled in aerospace. For this, Rolls-Royce engineers worked in partnership with aviation energy storage specialist Electroflight and automotive powertrain supplier YASA.

Stjohn Youngman, Managing Director,

Electroflight said the next step would be to adapt the new electric propulsion technology and battery system to be applicable across the wider aerospace industry to deliver a more sustainable way to fly.

Under the ACEL program, supported by Jaguar Land Rover, Rolls-Royce is looking to make aviation more sustainable. In June, the company announced its pathway to net zero carbon emissions, committing to ensure our new products will be compatible with net zero operation by 2030 and all products will be compatible with net zero by 2050. ■



Japanese utilities to draw up decarbonisation roadmap for Indonesia

TEPCO Power Grid, JERA and Tokyo Electric Power Services (TESPCO) agreed to carry out a data collection survey on Indonesia's decarbonisation pathways. With 6-7% GDP growth since 2010, Indonesia sees strong electricity demand growth which is currently mainly covered by coal, but the Government in Jakarta told the UN it seeks to achieve carbon neutrality before 2060.

The Indonesian government is hence working with the Japan International Cooperation Agency (JICA) and the four Japanese companies said they will conduct the survey under the umbrella of the Asia Energy Transition Initiative (AETI).

Indonesia consists of many islands, similar to Japan, hence JERA believes it will be able to leverage its experience gained in drawing up a decarbonization roadmap at home. As one of the world's leading LNG importers and traders, JERA has the potential to help finance the conversion of coal-fired

power stations in Indonesia to natural gas and then fuel these revamped power units with super-chilled, cleaner-burning gas.

Roadmap to be implemented by March 2022

TEPCO Power Grid, for its part, said it will focus on institutional and financial aspects when drawing up a roadmap on decarbonising Indonesia's power and gas transmission networks. This master plan will be worked out through TEPCO's overseas consulting business.

TESPCO meanwhile, will use its technical capabilities and expertise gained from working in developing countries in Asia and Africa to help support Indonesia's decarbonisation roadmap. No timeframe has been given as to when first results of the survey or the roadmap are meant though the actual roadmap is meant to be implemented by the end of March 2022. ■



INNIO's myPlant Optimisation tool uses AI for overall plant operation

Striving to shape the energy transition, INNIO Jenbacher's combined heat and power (CHP) systems supply climate friendly energy based on natural gas and hydrogen. And to best utilize complex, hybrid energy systems, the Austrian manufacturer developed myPlant Optimisation which uses artificial intelligence (AI) for overall plant operation.

Today, more than 10,000 plants worldwide can be operated economically through myPlant Optimisation tool, which evaluates over 900 billion data points per year. Olaf Berlien, INNIO President and CEO said myPlant Optimization offers a comprehensive software-based solution that understands the real challenges of plant operators while also helping to shape the energy transition.

The AI-based tool was developed in close collaboration with customers. "The Jenbacher energy management schedules are individually tailored to our plant. They show us clearly and simply when and how much output we will be trading on the electricity market," said Martin Buchholz, managing partner of Blumendorf Bio-Energie, one of INNIO's customers. "Ultimately, it's really important for us that we only generate electricity when it's the best time to trade it." ■

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