



Green hydrogen projects surge but developers hesitate to take FID

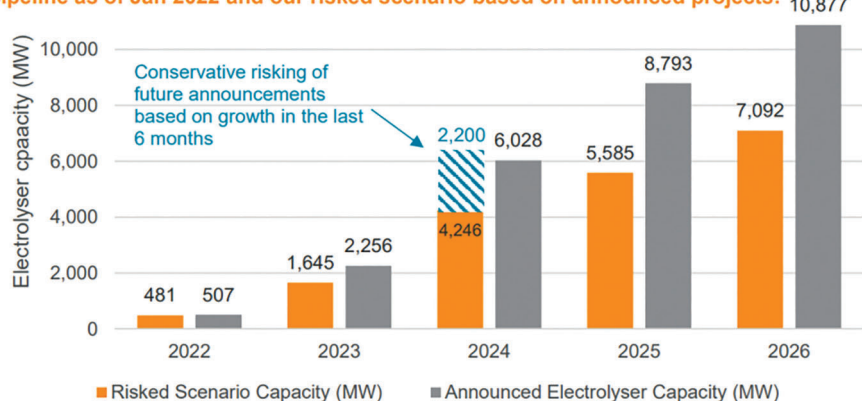
The project pipeline for new electrolyser capacity in Europe has increased to over 6 GW – a staggering 375%, or 4.4 GW, rise of ventures meant to come online by the end of 2024. But only few projects will go ahead, Delta-EE warns, unless developers and project sponsors get more clarity this year on national subsidies schemes and funding support.

For projects to move from 'planned – low risk' to 'planned – firm', they have to meet several criteria such as taking a final investment decision (FID), obtaining public funding, contracting equipment providers and signing offtake agreements with end-customers. "Only 26% of announced projects for 2023 are currently firm," analyst said, underlining: "This illustrates the importance of decisions in 2022, as project sponsors await national support schemes for green hydrogen."

Shift to commercial projects

The size of announced projects is rising rapidly as the capital-intensive sector moving from pilots to commercial projects. According to Delta-EE data, the average electrolyser capacity installed in 2021

Cumulative electrolyser capacity, Europe, comparing Delta-EE's announced pipeline as of Jan 2022 and our risked scenario based on announced projects.



was only 2.25 MW but is expected to exceed 50 MW in 2023.

More and more project sponsors try to sell "competitive" green hydrogen solutions to customers. "Project developers will not accept loss-leading projects at the 10s of MW scale," analysts stressed, hence they will wait until suitable policies will reduce the financial risk to an acceptable level before taking FID.

Green hydrogen projects typically consisted of electrolysers below 10 MW that relied completely on national and EU funding. Energiepark Mainz, for example, uses a 4 MW to provide electricity

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TES launches open season for Wilhelmshaven LNG project

Belgian start-up Tree Energy Solutions (TES), co-developer of the German North Sea LNG import project at Wilhelmshaven together with E.ON, has launched an open season to gauge interest. The regas terminal will initially import LNG to wean off Germany's dependence on Russian pipeline gas before switching to green hydrogen imports from 2030.

Eager to decarbonise, E.ON already sealed a memorandum of understanding with Fortescue Future Industries to import up to five million tonnes of green hydrogen from Australia or other locations. Shipments of green H₂ are slated to commence from 2030 but until then the German North Sea import terminal will source LNG for which TES has now asked for regas capacities, shipment offers or ideas.

"The open season is accessible to all parties seeking to import LNG in the drive to reduce EU and Germany energy dependence on Russia," TES said a statement. Parties are invited to submit an expression of interest to reserve capacity and services for the import of LNG volumes.



Render of Wilhelmshaven regas terminal

Transition from LNG to green hydrogen

TES is planning for initial capacity to import up to 16-20 billion cubic metres per annum (bcm/a) of liquefied natural gas from 2025 onwards. The terminal will be connected through a pipeline to the European high-pressure gas grid.

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network congestion management and frequency regulation. But after a heavily funded initial research phase, the developers have been running the plant at a loss to build experience in hydrogen gas grid injection and commercial hydrogen storage and distribution.

An early example of a more commercial focus is Hydrosponder, a 2 MW electrolyser and refuelling. It is running commercially without public support by virtue of an exemption of hydrogen fuel cell vehicles from the Swiss road tax regime. Hydrogen-fuelled cars thus become competitive with diesel incumbents.

Need to clarify national support schemes

Germany, the Netherlands and the UK are the three countries to watch in 2022 when it comes to green hydrogen. Policy makers in Berlin intend to double the 2030 target

for electrolysis capacity from 5 to 10 GW. To that end, they will set up additional subsidy schemes, including offering "Carbon Contracts for Difference (CfD)" as part of an Easter package of legislation. In Delta-EE's view, "the new coalition government puts Germany in a strong position to secure over 600 MW of currently uncertain capacity by 2023."

In the Netherlands, the new coalition government launched a €35 billion climate and transition fund, with €15 billion made available for decarbonising industry with new energy carriers which have not been specified yet. Though big on funding, the Dutch hydrogen policy "currently lacks definition," analysts criticised. "Despite having approximately 220 MW of uncertain projects planned to 2023, a lack of definition here will hurt project organisers," analysts warn.

The UK Hydrogen Strategy, meant to be

fully implemented by the end of 2022, sets a standard for low carbon hydrogen. Signs point to a contract for difference (CfD) style incentive for production with grey hydrogen as the benchmark. "However, it's unclear as to how the business model will treat green and blue hydrogen given the UK's focus on low carbon hydrogen," analysts remarked. "Also, given government deadlines tend to slip, we may not see these policies put in place until 2023 – and could see uncertain project remain so in 2022."

In the last six months, some 4.4 GW of new capacity was announced in Europe for 2024. "If similar growth is seen in 2022, and we assume a conservative risk factor of 50%, then the capacity becoming operational by the end of 2024 looks set to exceed the EU target of 6 GW," analysts concluding, counting on positive announcements for green hydrogen subsidies this year. ■

Gazprom halts supplies to Poland and Bulgaria

Gazprom has suspended supplies to both Poland and Bulgaria from today due to their refusal to pay in Russian roubles. Poland's state gas company PGNiG was given notice that deliveries through the Yamal-Europe pipeline would stop Wednesday. The 33 bcm/y interconnector carries Russian gas through Belarus and Poland to Germany.

The Polish Prime Minister Mateusz Morawiecki called the halt in Russian supplies "a threat" given that his country has been diversifying supplies, e.g. through the Swindowskie LNG import terminal. Staying defiant, PGNiG said it was considering legal action over Moscow's demand of rouble payment.

"There will be no shortage of gas in Polish homes," Climate Minister Anna Moskwa tweeted with reference to PGNiG's ample gas storage levels and the possibility to source additional LNG through the Swinoujscie regas terminal, on the Baltic Sea coast. Moreover, a gas pipeline from Norway will become operational later this year.

Bulgaria, meanwhile, is facing greater

challenges to find alternative supplies as the Balkan country currently covers over 90% of its gas needs with Russian gas. "The Russian proposal for a two-step payment procedure is in violation with the current contract and bears considerable risks for Bulgaria, including to make payments without receiving any gas deliveries from Russia," the Bulgarian government commented.

Still, the Bulgarian state TSO was quick to point out that no restrictions on domestic consumption would be imposed for now, but things may change as storage levels are

bound to fall quickly from already low levels. Bulgaria's Chiren gas storage facility was reported juts 21.64% full as of February 20 with 1.257 TWH of working gas volume in store, and filling levels are estimated between 15% and 17% these days. ■



Gas to Power Journal

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Capacity of Wilhelmshaven LNG terminal and connecting pipeline may be further expanded by adding further LNG tanks or a second pipeline for onward gas transport. Timing and size of this future expansion will hinge on Germany's LNG demand from 2025 onwards, as well as the planned transition to green and clean, hydrogen-based gas.

From 2027/8 onwards, the Wilhelmshaven regasification terminal will increasingly be reserved for imports of fossil-free green gas, developers explained.

"The TES-Wilhelmshaven project is unique in accelerating Germany's and Europe's plans to decarbonise the energy market at scale whilst creating the opportunity to shift away from Russian gas imports as the way out of the current energy crisis," Otto Waterlander, Chief Commercial Officer at TES said, adding: "The open season makes it possible to materially meet the needs of the market and will help provide energy security for Germany and the rest of Europe by accelerating the growth of green gas imports." ■

Global gas demand to grow 10% in next decade, McKinsey finds

Though oil demand is projected to peak as soon as 2025, natural gas will play a pivotal role throughout the energy transition with demand set to grow by 10% in the next decade before peaking by 2035, McKinsey forecasts. Investment in sustainable fuels – particularly hydrogen – is anticipated to reach up to \$50 billion over the next three years.

Today's energy markets face an unprecedented array of uncertainties, including the conflict in Ukraine. Nonetheless, the long-term transition to low-carbon energy systems sees strong momentum, analysts noted and, in several respects, acceleration. By 2050, however, hydrogen and hydrogen-derived synfuels are expected to account for 10% of global final energy consumption, McKinsey analysts write in this year's Global Energy Perspective report.

New RES priced lower than fossil fuel alternatives

Rapid technological developments and supply chain optimisation have collectively halved the cost of solar, while wind costs have also fallen by almost one-third. "As a result, 61% of new renewable capacity installation is already priced lower than fossil fuel alternatives," analysts find, adding battery costs have also fallen by nearly half in the past four years.

As a consequence, the share of renewables in power generation is forecast to double in the next 15 years – not least because Europe strives to reduce its dependence on Russian oil and gas imports. Fossil fuel demand is projected to peak before 2030 – though the speed depends on the scenario.

"Every year we've published this report, peak oil demand has moved closer. Under our middle scenario assumptions, oil de-

mand could even peak in the next three to five years, primarily driven by electric vehicle adoption," says Christer Tryggstad, a senior partner at McKinsey. Going forward, he expects the global energy mix will shift to low carbon-solutions: Renewables are projected to grow 3x by 2050, accounting for 50% of power generation globally already by 2030 and 80-90% by 2050.

Rapid EV adoption accelerates peak oil

Uptake of clean fuels is gaining momentum: Hydrogen demand is expected to grow 4-6 times by 2050, driven primarily by road transport, maritime, and aviation. Hydrogen and hydrogen-derived synfuels are seen to account for 10% of global final energy consumption by 2050.

Rapid electric vehicle adoption may herald peak oil demand already in the next three to five years. Carbon Capture Utilization and Storage (CCUS) could grow more than 100-fold by 2050 from an almost non-existent footprint today – with "investment opportunities exceeding LNG markets today."

Leading up to COP26, a total of 64 countries, covering more than 89% of global emissions, have pledged or are legislated to achieve net zero in the coming decades. But even with a 85% renewable power system by 2050, rapid EV uptake and use decarbonisation technologies by power plants and

industry, McKinsey still projects global warming will exceed the target.

"Even if all countries with net zero commitments deliver on their aspirations, global warming is still expected to reach 1.7°C. To keep the 1.5°C pathway in sight, even more ambitious acceleration is needed," Tryggstad concluded on a rather downbeat note. ■

Soaring energy prices lead to record inflation in Germany and the UK



Skyrocketing energy and food prices have pushed up UK inflation to 7% in March – the highest for 30 years – and analysts say it is on track to reach 8% this month. Germany was hit by a 7.3% rise in inflation in March as energy prices soared nearly 40% year-on-year, prompting the government to grant state aid to selected companies.

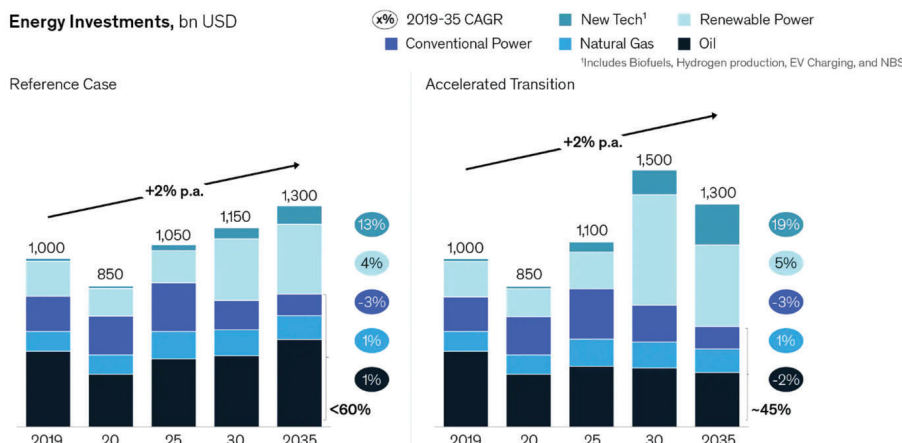
In addition to the pandemic, the war in Ukraine has a marked impact on prices for heating oil, petrol, natural gas and electricity, economists pointed out. Inflationary pressures and soaring fuel prices could limit the EU Commission's plan to replace 112 bcm of Russian gas imports by end-2022 through greater LNG purchases, Fitch Rating suggested.

In Germany, the rise of the national CO2 price on transport and heating fuels from €25 to €30 had an additional upward impact on inflation. Overall, energy prices in March soared 39.5 % year on year in Germany, according to Destatis figures. Heating oil more than doubled following a 144% price jump, motor fuel rose over 47%, and natural gas price increased 42%. ■

As investment shifts to new technologies, fossil fuels will make up less than 60 percent of total investments in a Reference Case scenario and about 45 percent in an Accelerated Transition scenario by 2035.

McKinsey
& Company

Energy Investments, bn USD



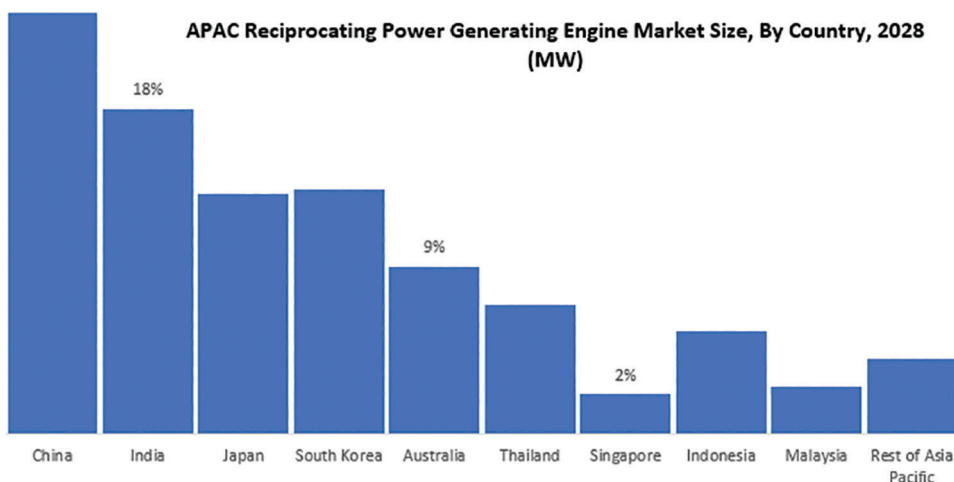
Recip engine industry to reach \$34 billion market value by 2028

Rapid industrialisation across Asia Pacific and a trend to decentralized power generation is driving demand for modular and fuel-flexible reciprocating gas engines. Global Markets Insights expects the recip engine industry to reach a market capitalization of \$34 billion by 2028, up from currently \$27 billion.

Manufacturers are striving to co-fire recip gas engines with sustainable fuels. Wärtsilä in July 2021 began testing its reciprocating internal combustion engines to run on pure hydrogen in Finland. The OEM is now testing other internal combustion engines to optimise hydrogen co-firing in anticipation that G20 nations will need approximately 933 GW of carbon-neutral thermal balancing capability to reach Net Zero.

Caterpillar just launched Cat G3516H, a 100% hydrogen-operated generator set that runs at up to 1250kW on 50 or 60Hz. The product supports the company's initiative to help create a hydrogen economy and to reduce greenhouse emissions.

China's No. 711 Research Institute in December created the world's most robust Stirling engine under China State Shipbuild-



ing Corp. By applying submarine propulsion and power generation, it can be integrated with any heat source – be it conventional or

nuclear. The prototype raced at a power of 320 kW with a 40% fuel conversion efficiency during the performance test. ■



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Trials start to track, store and trade excess solar power in Japan

NGK Insulators has started a trial project in April together with Ricoh to track the charging and discharging of surplus renewable energy in batteries. The tracking system will be tested at Japan's regional utility Ena Electric Power with the aim of building a system that allows for solar power to be shared, stored and traded.

In Ena City, a city with some 50,000 inhabitants in Gifu Prefecture, the regional power producer is installing solar PV on the roofs of public buildings, combined with NAS batteries in unused plots of land without relying on the Feed-in Tariff system.

Parts of the solar power will be supplied to Akechi Insulators, an NGK Group company and at the same time Ena Electric will build a decentralised power system based on solar PV and NAS batteries. Demonstration test will seek to maximise the use of renewable energy with the help of blockchain-based distributed ledger technology, developed by Ricoh.

NGK and Ricoh will also examine the option of remotely linking energy storage, solar PV and other forms of power generation with those of Ena Electric Power to conduct joint tracking.

Track, share and trade

Real-time tracking of all renewable energy

generated in the distribution network, along with consumption and storage of surplus energy in NAS batteries, helps prevent a backflow of surplus renewable energy from entering into the grid. That way local solar power generation can also be used locally, without potentially disturbing the stability of the main transmission grid.

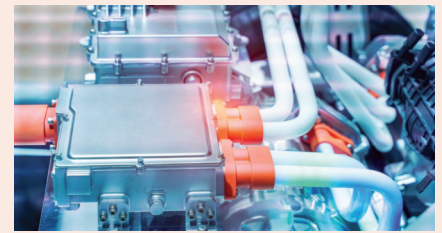
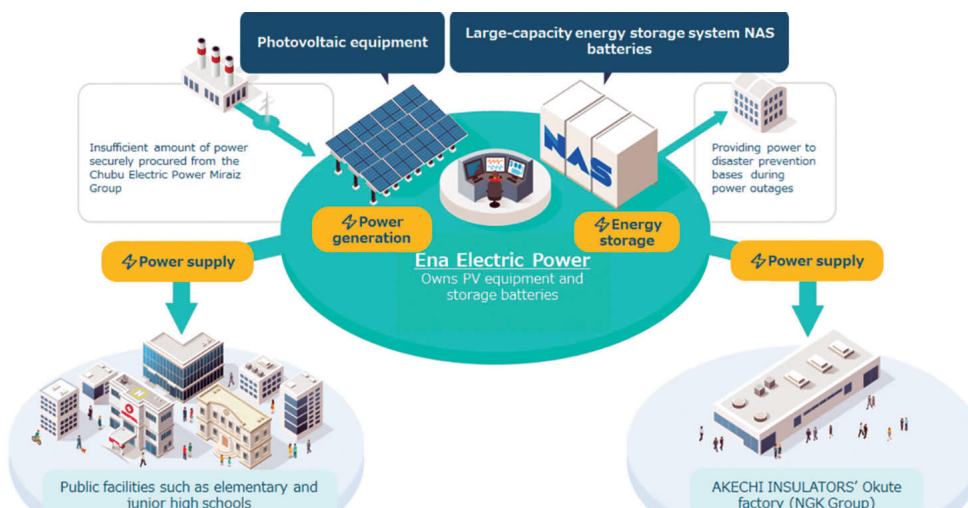
Sharing and trading of excess renewable energy may be difficult, NGK concedes – but at times of no restrictions on the grid, any excess solar power stored can be transmitted to different distribution network. This would allow utilities like Ena Electric to reap revenue from selling and trading excess renewable energy.

NGK and Ricoh underlined their commitment to build mechanisms to easily share and trade renewable energy to incentivise the build-out and maximisation of wind and solar power installations with a view of Japan realizing carbon neutrality by 2050. ■

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Sharing and trading of excess renewable energy may be difficult, NGK concedes – but at time of no restrictions on the grid, any excess solar power stored can be transmitted to different distribution network

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JERA and Sumitomo to reuse EV batteries for energy storage

Japan's largest power producer JERA will get state funding for recycling lithium-ion batteries from electric vehicles (EVs) for energy storage. Researchers will demonstrate a non-roasting method for separating and collecting battery materials by utilizing JERA's high voltage pulse technology. The cathode materials will then be recycled without returning them to metal.

As a next step, Sumitomo Chemical plans to develop an upcycling technology that raises the cathode materials' performance to at least the same level as before recycling. This would allow the energy storage units to work as efficiently as the car batteries.

The number of electric vehicles on Japan's roads is rising fast in line with the government's bold pledge to reach Net Zero emissions by 2050. But Japan is country with very few natural resources, so separating and collect the rare metals contained in used car batteries for energy storage is not only sustainable but also cost-efficient.

Upcycling EV batteries

Through JERA's high voltage pulse technology and Sumitomo's upcycling method, both companies aim to efficiently reuse cathode materials and other battery materials without oxidation or degradation. The current roasting method, however, not only emits CO2 but also oxidizes and degrades the materials which makes it difficult to efficiently collect rare metals. These challenges are meant to be solved as the project runs through FY2030.

Under its "JERA Zero CO2 Emissions 2050" objective, Japan's largest LNG importer and power producer seeks to develop and deploy energy storage systems to optimise the use of renewable energy to realize a decarbonized closed-loop society. Sumitomo Chemical also formulated a "grand design" to achieve carbon neutrality by 2050 but fell short of specifying which methods will be use. ■



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First hydrogen co-firing at GE's HA-class turbine at Long Ridge

Long Ridge Energy Terminal in Ohio, home to a 485 MW combined-cycle power plant, is where a GE HA-class gas turbine has for the first time been co-fired with hydrogen in a commercially operating generator. Following the completion of blending tests, the CCGT is now partially running on hydrogen produced as by-product from a nearby industry.

“Our Hannibal power plant is the first GE H-class plant worldwide in commercial operation to blend hydrogen successfully,” said Bo Wholey, President of Long Ridge Energy Terminal said, calling the move a “profound achievement for Long Ridge Energy Terminal, GE, and the entire power generation industry.” The CCGT will deliver low-carbon energy to local customers, notably data centres and technology companies.



Long Ridge CCGT in Hannibal, Ohio

Though the CCGT at Long Ridge started commercial operations already in October 2021, efforts to convert the 7HA.02 gas turbine to hydrogen combustion did not start before spring 2022. A test for using a hydrogen-blended fuel was completed on March 30, paving the way for the CCGT to now source up to a fifth of its fuel needs from emissions-free hydrogen.

Boosting the co-firing rate

The 7HA.02 gas turbine can burn between 15-20% hydrogen by volume in the gas stream initially and is meant to utilize up to 100% hydrogen over time. For the demonstration, an initial blend of 5% hydrogen by volume and natural gas was injected into the turbine's combustion system and further upgrades could boost this rate, subject to fuel availability and economics.

“Pre-combustion decarbonization is something we can and must pursue today” – even on GE's largest utility scale HA gas turbines – “to demonstrate that gas generation can be a destination technology in the energy transition,” said Scott Strazik, CEO of GE's Global Energy Business Portfolio. The American manufacturer vast hydrogen fuels experience across non-HA gas turbines, where it has more than 8 million operating hours burning hydrogen or similar low carbon fuels.

Going forward, Long Ridge Energy Terminal plans to produce hydrogen onsite – potentially from wind or solar – and the power plant operator is also considering the use of below-ground salt formations for large-scale hydrogen storage. That way the CCGT could accommodate seasonal fluctuations related to renewable power, to cost effective, dispatchable intermediate and baseload power. ■

Japanese trio set up a hydrogen and ammonia supply base in Kanagawa

Three Japanese energy majors – ENEOS, JERA and JFE – strive to set up a hydrogen and ammonia receiving and supply base at Keihin waterfront in Kanagawa Prefecture in the greater Tokyo area. Hydrogen and ammonia emit no CO₂ during combustion so both fuels will be used at scale to clean up power generation and petrochemical processes.

The trio first wants to set up a base to import the green fuels at Keihin and then distribute them through a dedicated new supply network, possibly via regional pipelines or special carriers.

The Keihin hub will be situated in the centre of the Kanto region where ENEOS owns refineries and an onsite power plant. JERA also owns thermal power stations nearby, all designated for ammonia co-firing, as well as and LNG receiving terminal. The third partner JFE is working with Kawasaki City for repurposing land for energy-intensive industries and new power gen projects.

Hekinan – JERA's ammonia pilot project

JERA, Japan's largest power producer, is committed to switching 20% of the fuel at Unit 4 of its Hekinan Thermal Power Station to ammonia by the late 2020s. As the Hekinan demo project progresses, JERA now wants to procure and import ammonia at large and supply it to various Japanese

power producers. In mid-February, it conducted a competitive bid to procure up to 500,000 tons of ammonia per year under a contract running from 2027 until the early 2040s.

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

Hydrogen – set to power Fuel Cell Vehicles

The petrochemical major ENEOS is focussed on the mass consumption of hydrogen both from power generators but particularly from novel Fuel Cell Vehicles (FCVs). To that end, ENEOS strives to develop a CO₂-free hydro-



Keihin waterfront at Kawasaki City

gen supply chain to distribute the clean alternative to petrol and diesel through dedicated hydrogen fuelling stations. With the Keihin hub, ENEOS wants to set up a base to receive CO₂-free produced outside Japan and for supplying large-scale hydrogen customers in the vicinity.

JFE, meanwhile, will help to set up a hydrogen and ammonia supply chain by repurposing land that is part of JFE Steel's East Japan Works on Ogishima island. Through these and related initiatives, JFE hopes to play a leading role in realizing a zero-carbon metropolitan Tokyo. ■



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Stena Lines to run ships on electricity, sourced when in port

Four ferries of Stena Lines will soon run on electricity as the Swedish shipping company will retrofit the ships with Yara Marine's shore power solution. This allows the ferries to connect to the local grid when in port and electrify operations at sea, rather than using fossil fuel-based generators on board.

The short time out at sea of passenger ferries and ro-ro ships, compared to tankers or dry-bulk carriers, make them well suited for electrification. Finnlines in early April agreed to electrify some of its ro-ro vessels and ferries and said it will use these ships first in the Baltic and North Sea.

Singling out Stena Line's drive to sustainable operations, fleet support manager Hans Corneliusson said: "Connecting a single vessel to a green electrical grid when in port can reduce CO2 emissions by over 5,000 tonnes per year – and this effect is multiplied across our fleet." Anticipating a rising number of number of ports with shore-based power connectivity, Stena Line



The ferry 'Scandica' will be electrified

is happy to invest to make its fleet compatible with this technology.

"Our holistic approach to minimizing emissions by only sourcing renewable energy for shore power is in line with both customer expectations and upcoming regulatory requirements," Corneliusson explained.

Pledge to electrify ports by 2028

Shore power is an option for the shipping industry to reduce fossil fuel consumption and meet increasingly stringent emissions regulations. Numerous governments and port authorities signed a joint commitment for the electrification of ports by 2028 at the One Ocean Summit held in France in February.

But setting up shore power solutions can be technically challenging, particularly in cases where operators are using two or three different systems on board that are not compatible with each other. Yara Marine's turnkey shore power solution is reducing the complexity of installation, and mitigating project-related risks, such as fleet-wide installations. ■

NEWS NUDGES

Shell to fuel Nigerian IPP

Shell Nigeria Gas is considering supplying all necessary gas for a 225 MW independent power plant (IPP) project to be built in southwestern Nigeria. Under a heads of agreement (HoA), signed with the plant developer Coodsynergyn Oil West Africa, SNG agreed to build the necessary infrastructure to connect the power plant to the Escravos Lagos Pipeline System for easy access to natural gas.

GE bags LM2500 turbine order in Taiwan

Taiwan Power Company has handed GE an order for six LM2500XPRESS gas turbine packages. The modular and fast-ramp aeroderivative turbines to be installed at Taiwan Power's 175 MW power plant can quickly bridge gaps in supply during blackouts or electricity shortages. GE's proven LM2500 aeroderivative gas turbine technology is 95% factory assembled.

Wärtsilä to boost capacity of Borg El Arab power plant in Egypt

Kahraba, part of Egypt Kuwait Holding (EKH), has contracted Wärtsilä to add about 20 MW of output to the Borg El Arab power plant, situated southwest of Egypt's largest coastal city Alexandria. The plant, currently powered by four Wärtsilä 34SG engines running on natural gas, will be upgraded with two further engines and a control system.

The extended Borg El Arab plant (60 MW) is expected to become fully operational in 2023. Its operator Kahraba is one Egypt's most prominent independent power producers (IPPs) and also country's only authorised private buyer and seller of gas.

"Industrial growth is vital to the region's [of greater Alexandria's] economic development, and a reliable power supply is essential for driving this growth," said Magdi El Badry, Chairman & Managing Director of Kahraba. He expressed satisfaction with the approach of Wärtsilä's personnel in serving Kahraba's needs to optimise operations at the Borg El Arab power plant.

Balancing rising renewable energy supply

Electric utilities in Egypt are making increasing use of the country's abundant potential for wind and solar power. The government

in Kairo has set targets for renewables to comprise 42% of the country's electricity mix by 2035, based on rapid solar and wind energy deployment.

Fast-starting and stopping capabilities of gas engines are vital to compensate for the intermittent supply from renewable power sources to keep the grid in balance. "By operating the engines on locally available natural gas, the plant's environmental footprint is lessened. Furthermore, the flexible engines will enable the system to incorporate increasing levels of electricity from renewable sources," said Marc Thiriet, Director, Wärtsilä Energy, Africa West.

Wärtsilä gas engines are ready to run on sustainable fuels – notably synthetic methane and methanol as well as hydrogen



blends – once they become widely available, which "makes them a future-proof solution," the manufacturer pointed out.

Egypt has one of the largest electricity grids in the African continent. In recent years, there have been significant additions of large centralised generation capacity, notably three Siemens-built combined-cycle power stations at Burullus, Beni Suef and New Capital with a combined capacity of 14.4 GW. ■



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