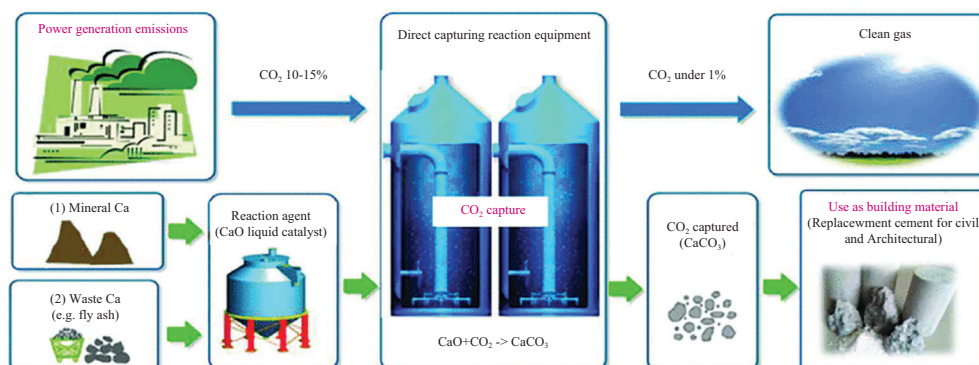




"CCU needs to be applied together with direct-air-capture," UBA argues

Carbon capture and utilisation (CCU) only make sense together with direct-air-capture technologies. Hydrocarbons will be needed in the long term even in a CO₂-neutral economy, whether in artificial paraffin or for plastics, analysts at Germany's federal environment agency (UBA) say but "future carbon cycles can only be closed permanently with additional carbon extraction from the atmosphere."



“If fossil carbon is captured by CCU and used elsewhere, it always ends up in the atmosphere at the end of the use chain, regardless of the number of subsequent uses,” researchers said in a study compiled on behalf of the German government.

The debate around negative emission has been gaining traction in Germany in the wake of the COP26 Climate Summit in Glasgow. All projections show there won't be a way around direct-air-capture of CO₂ in 2045, when Germany aims to be climate neutral.

Gov' supports carbon extraction

Hydrocarbons will be needed in the long term even in an efficient

and greenhouse gas-neutral economy, whether in artificial paraffin or for plastics, but "the future carbon cycles can only be closed in the long term and permanently with additional carbon extraction from the atmosphere," the UBA-study reads. In consequence, the government sees a need to promote technologies for carbon extraction from the atmosphere today so that they are available on a sufficient scale later.

CCS needs rapid renewables roll-out

A prerequisite for using CCU technologies is a rapid roll-out of a renewable energy-based electricity system – nationally within Germany, but also Europe-wide and globally – simply

continued on page 2

Germany won't be able to import enough hydrogen to meet target

Despite Berlin's efforts to promote clean energy use, Germany will not be able to import enough renewable hydrogen to reach the targeted 76 - 96 TWh by 2030, as laid out in the national hydrogen strategy. "The problem is that expansion of renewable energies in countries like Chile, Morocco, Spain and the Netherlands is progressing only slowly," said Malte Küper, analyst at the German Economic Institute (IW).

Even if the four most promising export countries would only supply Germany, quantities are projected to be insufficient, the IW researchers found when compiling an analysis together with the Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT).

One key issue is that the transport of large quantities of hydrogen by pipeline or ship is still being developed or approved and cannot be implemented quickly enough. "We are talking about enormous quantities that will be needed in a short time," said Küper, who co-authored the study.



Kawasaki-made 'Suiso Frontier' - the world's first liquid hydrogen carrier

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because CCS technology requires a lot of energy.

"CCU with direct air capture should only be used once renewables have reached a share of more than 80% of power supply,"

analysts at the UBA stressed. "Anything else would endanger the short and medium-term climate targets."

Many analysts argue industrialised countries should rush to build up a new indus-

try of CO2 removers, scale it up and drive down prices, but others warn that relying on removal methods only draws attention away from the task of avoiding emissions altogether. ■

E.ON to invest €27bn in grids and retail, in similar move as rival RWE

German utility E.ON plans to invest over €27 billion (\$30bn) in its core business – grids and retail power – by 2026, joining rival RWE which said a week earlier it will spend €50 billion (\$57bn) through 2030 to double its green power gen capacity. "The decarbonisation of Europe's economies places the energy industry at the threshold of a key decade of growth," commented E.ON CEO Leonhard Birnbaum.

E.ON's investment programme foresees around €22 billion to be spend on the company's power and gas distribution network, plus an additional €5 billion on customer solutions in its retail power segment. As one of Europe's largest utilities, E.ON supplies around 50 million customers across the continent.

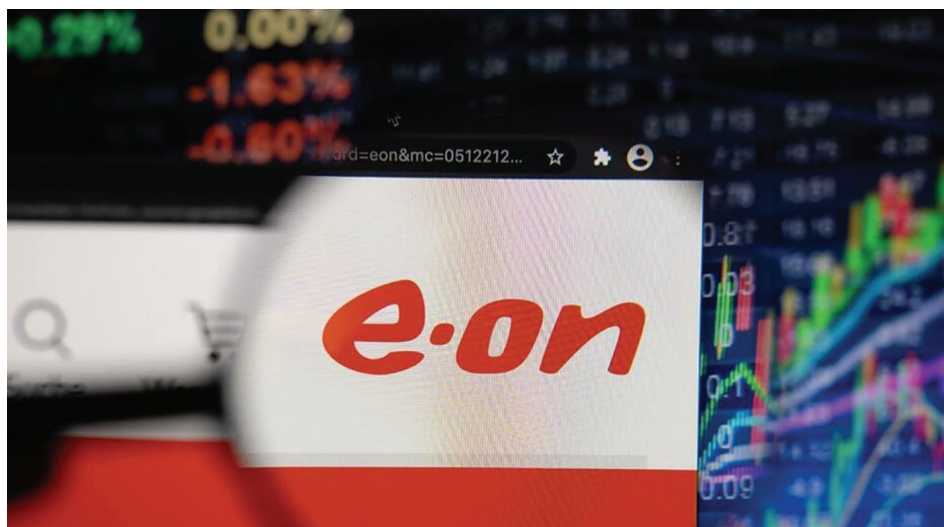
Shares in E.ON fell after the announce-

ment, trading down from €11.136 to €10.556 but have recovered slightly this morning.

As part of its latest 5-year plan, E.ON aims to reap between €2 billion and €4 billion in proceeds from asset sales and partnerships. In addition, it aims to save around €500 million by streamlining its operations by 2026.

Adjusted earnings before interest, tax,

depreciation, and amortisation for its core business is expected to reach €7.8 billion in 2026, which would represent a compound annual growth rate of about 4% from 2021 to 2026, the Düsseldorf-based company said. E.ON proposed to pay a dividend of €0.49 per share for 2021, as the company's current dividend policy foresees a 5% annual growth rate which will be extended by three years until 2026.



RWE to double green energy capacity

Striving to decarbonise and move away from coal power, has announced plans to spend €50 billion through 2030 to double is power generation capacity from green energy sources to 50 GW. The Essen-based company said its explicit aim is "to become global renewables heavyweight."

Hydrogen is also front and centre in RWE's future energy plans. "When you look long term, there is no way around hydrogen," CEO Markus Krebber commented, indicating the fuel's key role in decarbonising industries which cannot electrify like steel and parts of the chemical industry. ■

Gas to Power Journal

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No short-term investment security

Though many regions of the world have been found to "offer large import potentials in the long term," Küper but warned that sectors such as steel needed short-term security for the huge investments required to switch to climate-neutral processes.

The German government seeks to promote hydrogen as a fuel for energy-intensive industry, transport and aviation – all sectors that cannot be electrified directly. However, due to its geography and climate, Germany lacks the potential to produce enough hydrogen domestically to cover its needs.

Imports had long been hailed as a "way out" but "as long as the demand cannot be covered by imports, domestic hydrogen production from renewable energies must be massively increased," the IW said. But this would require a lot of green electricity in the coming years," whose expansion has been below target-volumes in recent years."

Researchers from IW and the Fraunhofer Institute also warn against dependence on individual countries for hydrogen, just as there is for natural gas. Instead, Germany has been urged to coordinate with other European countries to strive for a broad portfolio of export partners. ■

Hyosung HI selects hydrogen-ready Jenbacher engines for pilot plant

Hyosung Heavy Industries (Hyosung) has ordered H2-ready Jenbacher engines from INNIO for the first pilot power plant project in Asia Pacific to be 100% fuelled by hydrogen. The pilot plant will be built at the Hyosung Chemical Yongyeon Plant in Ulsan, South Korea, and is due to start commercial operations in the third quarter of 2022.

The project will set a benchmark in the wider region and is hoped to serve as the basis for multiple similar projects. Hyosung said its H2 pilot plant is scheduled to complete the demonstration by end of 2022.

"We have joined forces with INNIO to support our efforts to reduce carbon emissions while exploring commercial and sustainable opportunities related with our hydrogen by-product production," said Hyosung's general manager Park Jeong-Ha. "Our climate change response strategies aim to reduce emissions and energy consumption while increasing energy efficiency. INNIO Jenbacher provides the efficient and proven technology that helps us meet this goal," he added.

For INNIO, the pilot at the Chemical

Yongyeon Plant in Ulsan will be the second power plant in the 1-MW range that can run fully on hydrogen. The first Jenbacher 150-kilowatt pilot engine ran on 100% hydrogen at a demonstration plant operated by HanseWerk Natur in northern Germany. At the first test unit, HanseWerk used variable hydrogen and natural gas mixtures with up to 100% hydrogen on an INNIO Jenbacher engine.

Olaf Berlien, INNIO chief executive said the company's strategy is based on hydrogen becoming a driver of the energy transition. "We launched our 'Ready for

Hydrogen' portfolio to meet customers' demands for sustainable solutions, such as at Hyosung, to establish hydrogen-based power generation," he said, expressing pride to have become Hyosung's "hydrogen engine technology partner of choice." ■



Hyosung's polypropylene and by-product hydrogen production plant in Ulsan

H2 Green develops clean energy hub at Shoreham Port

H2 Green, a Getech business, will develop a clean energy hub – hydrogen, integrated with onshore wind and solar power – at Shoreham Port in Suffolk, UK. The clean energy hub will remove emissions from the port operator's fleet of trucks and heavy good vehicles, and could supply hydrogen as a feedstock for gas-fired power stations nearby.

Transport decarbonisation has been in the spotlight at the COP26 Climate Summit in Glasgow last week. At Shoreham, the port operator's entire fleet of trucks and cars will be powered either by hydrogen derived from renewable energy sources – so-called 'green hydrogen'.

Industries operating in and adjacent to Shoreham Port include gas power stations, timber and steel handling, and water treatment which are all seen as potential cus-

tomers for the hub's hydrogen-based electricity. By-products of the hydrogen production process – notably oxygen – can be used to treat local sewage to prevent planned releases to sea.

FID planned for summer 2022

Engineering designs have been finalised so upon receipt of planning approvals, the parties want to move towards a structured series of Final Investment Decisions (FIDs) in the second half of 2022.

Tom Willis, CEO of Shoreham Port said the project could make a significant contribution to the net zero ambitions across South East England.

"The hydrogen production process is quiet, odourless and the clean fuel produced will reduce

emissions across the region as transport operators convert large fleets to run on it," he explained, underlining his dedication to work with all shareholders to "make this project a success."

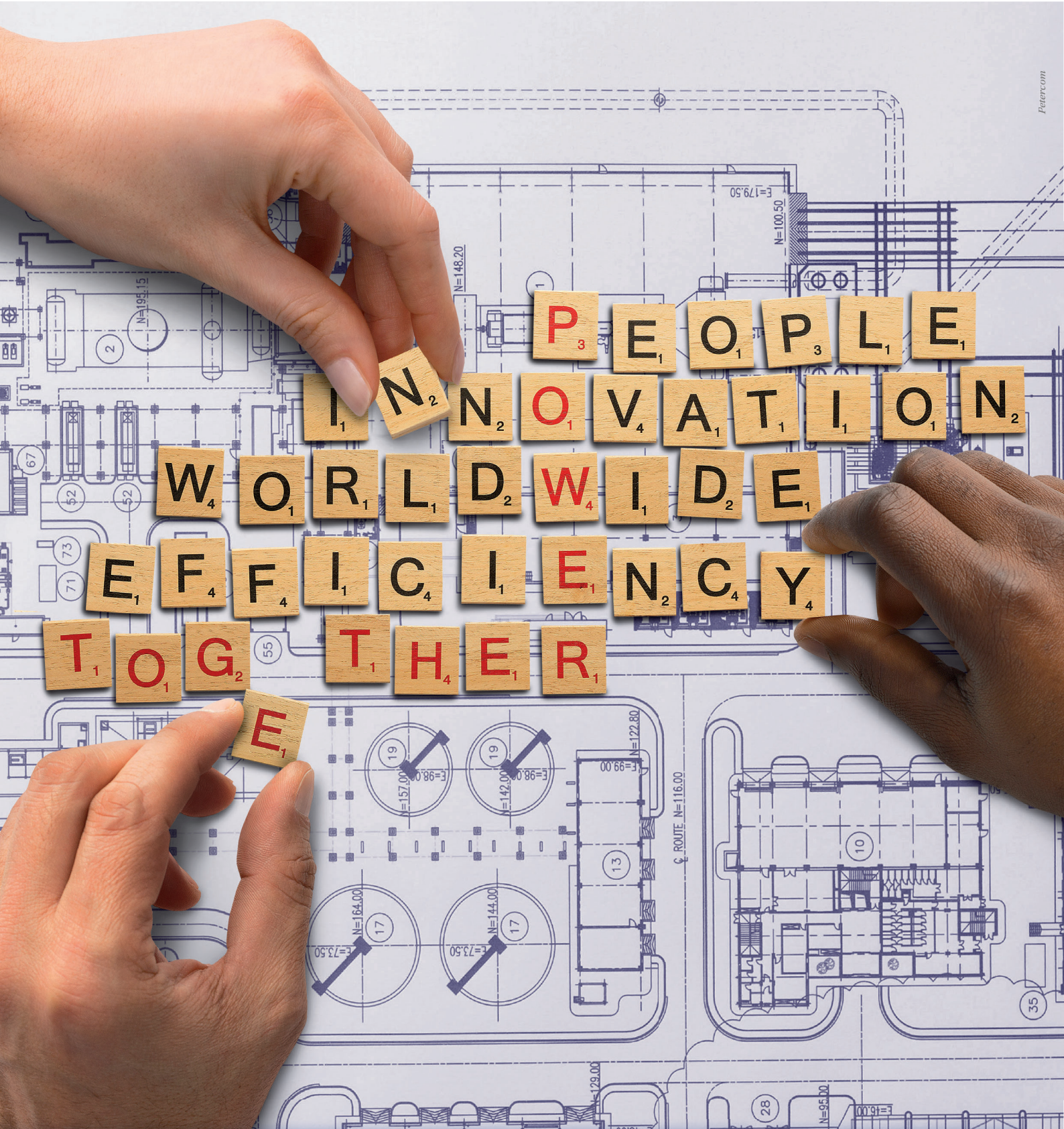
Ammonia imports also via Shoreham Port

Another zero-carbon energy carrier, Ammonia, is also meant to be imported to the UK via Shoreham Port through a designated import terminal. The multi-use facility will also be able to carry hydrogen imports, linking the British hydrogen industry to a growing number of green energy projects worldwide.

Luke Johnson, managing director of H2 Green, said the company worked closely with Shoreham Port to develop a bold vision and deliver significant emissions reductions to support the port's net zero goals and also benefit its customers and the wider economy. "Decarbonisation of the HGVs and forklift trucks entering and using the Port would save 45,000 tonnes of CO2 each year," he explained, adding Shoreham Port is one of only two to achieve Port Environmental Review System (PERS) certified EcoPort status. ■



Luke Johnson of H2 Green and Tom Willis of Shoreham Port

A close-up photograph showing three hands of different skin tones placing wooden letter tiles onto a technical architectural drawing. The tiles are arranged to spell out the phrase 'PEOPLE INNOVATION WORLDWIDE EFFICIENCY TOGETHER'. The tiles are light-colored wood with black or red letters and small numbers in the corners. The background is a detailed blue-lined technical drawing with various geometric shapes, circles, and text like 'ROUTE N=116.00'.

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Soaking up CO2 from the air underway in California

ExxonMobil and Global Thermostat, an R&D firm, have been testing an agile solution of soaking up carbon dioxide emissions from the air – notably from industrial facilities and power stations – at a pilot plant in California. Once economically viable, the solution could help meet the world's climate goals.

The technology works by vacuuming emissions from the environment, using a fan that pipes in air and chemicals called amines that remove the CO2 from the air, industrial facilities or power plant flue gas. The amines are essentially filtering and capturing those CO2 molecules, which can then be sequestered for use in the chemical industry used for

enhanced oil recovery. Test runs are currently underway at a pilot plant at SRI International, an R&D facility in California. The data collected there will help ExxonMobil evaluate possibilities to scale it for broader global application.

Striving to scale-up the solution

"Our scientists see potential in this exciting

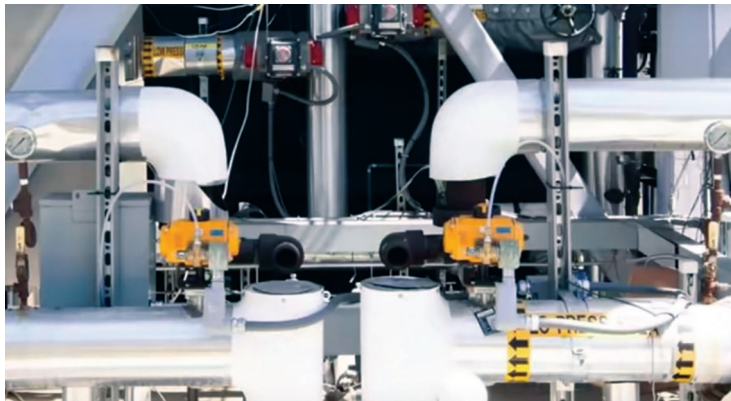
new technology that could lead to more affordable means for reducing emissions in the power generation and industrial sectors, and also for potentially removing carbon dioxide from the atmosphere," said Vijay Swarup, vice president of research

and development at ExxonMobil.

Global Thermostat, launched in 2010 by Dr. Peter Eisenberger and Graciela Chichilnisky, is cooperating with ExxonMobil because scaling solutions and getting from the R&D stage to commercial implementation requires significant investment.

"Our direct-air capture and flue gas capture technologies offer a way to transform the growing risks associated with carbon dioxide emissions into a global solution that could satisfy both business and environmental objectives. By partnering with ExxonMobil, we're harnessing the expertise and capabilities of one of the world's largest energy companies to accelerate our ability to realize that vision," said Peter Eisenberger, CTO and co-founder of Global Thermostat.

Since 2000, ExxonMobil has invested more than \$9 billion in energy efficiency and low-emission technologies such as carbon capture and next generation biofuels. ■



Inside view of CO2 capture plant

Siemens Energy to produce SF6-free switchgear in Berlin by 2023

Striving to eliminate greenhouse gases from power transmission, Siemens Energy is investing over €60 million in a new factory, where vacuum interrupters without fluorinated gases – especially sulfur hexafluoride (SF6) – will be manufactured within the company's switchgear plant. The new facility is scheduled start producing in 2023.

Switchgear ensures that power is distributed from substations to end-consumers, or from decentralised power generation sites like wind turbines to the centralised power transmission grid.

The problem is that fluorinated gases (F-gases) are usually used for insulation and as the switching medium in these systems, especially sulfur hexafluoride (SF6), the most potent greenhouse gas in the world. One kilogram of SF6 is equivalent to 25,200 kilograms of CO2 in terms of its climate-damaging effects, and it remains in the atmosphere for about 3,200 years when emitted.

"The consequences of rapidly advancing global warming require a fundamental change in the way we deal with energy, including power transmission," said Ulf Katschinski, Senior Vice President Switching Products and Systems at Siemens Energy. "Siemens Energy aims to sell only F-gas-free high-voltage switching technology starting in 2030 at the latest. With our new vacuum

interrupter production, we're laying the groundwork to achieve this goal and meet the growing demand for climate-neutral switchgear."

Replacing F-gases with Clean Air

The European Commission (EC) is currently working to revise regulation on fluorinated greenhouse gases, which will likely restrict the use of new SF6-insulated equipment. Climate-neutral alternatives already exist, like vacuum interrupters in Siemens Energy's so-called "Blue Portfolio" which includes high-voltage switchgear up to a voltage level of 170 kilovolts (kV). Looking ahead, Siemens Energy is working to further develop them for a voltage level up to 400 kV.

But instead of

using F-gases, all switchgear in the Blue Portfolio use vacuum interrupters and industrially purified air (so-called clean air) made from natural oxygen and nitrogen.

The new production facility in Berlin will be fully digitally connected and have highly automated equipment. Like the entire Siemens Energy switchgear plant in Berlin, the new production facility will also be powered 100% by electricity from renewable sources. ■



Representatives of Siemens Energy, the German Bundestag and the Senate of Berlin at the switchgear plant

GE delivers first repaired HA component from AMRT Center in Singapore

Improving its servicing capabilities, GE has delivered the first repaired HA component from its recently opened Advanced Manufacturing & Repair Technology Centre (AMRT) in Singapore. The new repair hub reduces repair-time for H-Class turbines in Asia where GE has over 90% in-region self-sufficiency for repair of heavy-duty gas turbines and a growing installed base.

With 60% of the global population and 45% of the world's electricity consumption, Asia is one of the fastest-growing regions in the world. Currently over one-third of the turbines are located, or are on order, in the region and GE expects to sell more HA gas turbines and components to Asian electric power generators.

First delivery of a repaired component is a milestone for GE, considering the American manufacturer announced in 2019 it will invest up to \$60 million over 10 years to make its Global Repair Solutions Singapore Center (GRSS) a world leader in power generation technology development, implementation and repairs."

"This investment allowed the shop to grow from 250 to 350 employees in two years, adding positions for both HA and aeroderivative repair business," GE said in a statement.

Repair on HA nozzles and blades

Going forward, the aim is to handle increasingly complex repairs on HA turbines, including repair on nozzles and blades. Four new lean lines to repair the HA Hot Gas Path (HGP) components were also added to support the global 9HA component repairs demand.

"By autumn 2022, GRSS will also be qualified to support the 7HA HGP components repair within the Asia region," GE said.

ion cleaning capabilities which is expected to be completed by the end of 2021.

Tan Kong Hwee, executive vice president for the Singapore Economic Development Board congratulated GE on the successful delivery of AMRT's first repaired HA component leveraging advanced manufacturing technologies. "Tapping on the skilled talent base and robust infrastructure in Singapore (...) this center will contribute to our 'Manufacturing 2030' ambition to be a global business, innovation, and talent hub for advanced manufacturing and a future for more sustainable gas turbine technology," he said.

GRSS, as well as other repair shops in Asia, such as PT. GE Nusantara Turbine Services Shop Indonesia, forms part of GE's network of local repair capabilities for heavy duty and aeroderivative gas turbines in the region to provide 24x7 customer support and a quick turnaround. This repair network also demonstrates GE's commitment to regional innovation, and the growth of local talent and the supply chain. To date, the American manufacturer has more than 1,000 gas turbines installed in the wider Asia region. ■



View into GE's new repair center in Singapore

Focus on 3D printing and hydrogen

In the expanded site, researchers and engineers focus on advanced manufacturing applications (also known as 3D printing), adaptive machining, joining capabilities, and inspection technologies. The AMRT Center is also in the process of establishing hydrogen fluoride

Rolls-Royce wins contract to overhaul engines used in German trains

German state-owned railway company Netinera has signed an agreement with Rolls-Royce for the latter to overhaul up to 180 PowerPacks, based on mtu Series 183 engines. Netinera uses these PowerPacks in its regional trains of the type Siemens Desiro. The contract follows a similar deal for Alstom Lint trains.

At the moment, Rolls-Royce engineers are overhauling some 235 mtu PowerPacks for Alstom Lint trains and a further 13 mtu engines of type 16V 4000 R41 for ER 20 locomotives at its Reman site in Magdeburg. These works are also carried out on behalf of Netinera.

Dismantle, clean, test and rebuild

Reman is the site for industrial reconditioning of main components and engines alike. Standardised processes are used to dismantle and clean the mtu PowerPacks and engines and then to test and re-build them using Reman components or new parts. The process automatically includes

product improvements.

"The process is entirely anonymous, i.e. the customer does not necessarily get the same PowerPack or engine back as it handed in for refurbishment. The PowerPacks or engines reach their customers in as new condition," explained Marc Goldschmidt, vice president Remanufacturing & Overhaul Technologies at Rolls-Royce business unit Power Systems.

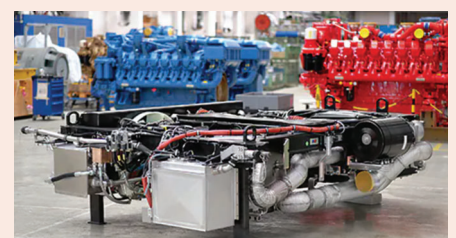
Swing units help reduce downtime

Once refurbished, PowerPacks are then ready for another 18,000 hours (roughly 720,000 km) of operation. For some engine series, exchange PowerPacks and engines – so-called swing units – can be provided before the drive systems are removed. By using swing units, the railcars and locomotives can be returned to service very quickly, which significantly reduces downtime.

"We are very pleased that Netinera has

once again chosen our Reman solutions," said "It shows how attractive our Reman PowerPacks and engines are: They offer absolute reliability and maximum availability at a very economical price," Goldschmidt commented on the latest order-win.

mtu PowerPacks not only contain engine and transmission but also all the ancillary units required to drive the vehicle, such as the cooling system and the exhaust gas aftertreatment system. Rolls-Royce Power Systems first developed this concept 25 years ago and has since delivered a total of more than 7,500 PowerPacks to rail customers worldwide. ■



mtu Series 183 engines

Innowatts uses Amazon Web Services to process 4.3bn data points

Software-as-a-service provider Innowatts has developed a cloud-based solution by using the agility of Amazon Web Services (AWS) to process 4.3 billion data points per hour. By combining Innowatts AI data-analysis tool with AWS's scalability and pay-as-you-go model, utilities can adapt their operations to customer needs and more volatile energy markets.

Utilities increasingly turn to data analytics to manage new demand and supply-side complexities, e.g. extreme weather events with sudden spikes in electricity demand. Load forecasting, demand analytics, and grid-edge management can be improved through predictive data analysis.

Digitalization transforms utilities' operations

Rolf Gibbels, head of business development, Power & Utilities Industry at AWS said the cooperation with Innowatts shows the importance of cloud-enabled digital transformation for utility companies. "It will help bring more sustainable, reliable, and affordable energy to millions of American businesses and residential customers," he said.

Innowatts' Core Analytics module uses meter data to segment electricity consumption by weather, time, and base-load criteria.

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. During the Covid-19 pandemic, this machine-learning platform helped energy providers rapidly adapt to changing conditions and lockdown-related demand fluctuations.

Model outperforms in EPRI study

Putting its capabilities to the test, Innowatt's AI-based forecasts outperformed all other prediction models in a year-long Electric Power Research Institute (EPRI) study, and outperformed rivals during the 2020 Texas heatwave, with a mean absolute percentage error (MAPE) of just 1.5%, compared to

more than 2% for the Electric Reliability Council of Texas (ERCOT) own forecast.

Jeff Wright, Chief Revenue Officer of Innowatts highlighted the cooperation with Amazon will bring the analytics solution to a wider audience. In his view, "the future of energy depends on using vast amounts of data gleaned from dispersed sources to generate actionable intelligence at scale — and that's exactly what Innowatts is now working to deliver."



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Siemens Energy secures €1bn order for LNG-to-Power complex in Brazil

Siemens Energy has secured a turnkey contract to build GNA II, a 1.7 GW integrated LNG-to-Power plant at Port of Açu, in the Brazilian state of Rio de Janeiro. Customer is Gás Natural Açu for whom Siemens commissioned the equally-sized GNA I complex in summer 2021 – at an overall project value of more than €1 billion.

The Açu Natural Gas project includes two power plants, a Floating Storage Regasification Unit (FSRU), as well as substations and transmission lines to connect the plants to the Brazilian national interconnected system. It is part of a wider gas hub under development at the Port of Açu with the aim of providing a logistical solution for the receipt, processing, conversion of LNG to electricity – based on natural gas from Brazil's Campos and Santos basins as well as for imported LNG.

GNA II plant run on H2-ready turbines

"This project is strategic, not only for its grandeur, but also for its geographical location, close to the two main gas pipelines systems in Brazil, in the Northeast and Southeast of the country," said Jochen Eickholt, board member of Siemens Energy AG. "And not to forget: Our gas turbines for GNA II are ready to burn hydrogen in the future. This means our technology is future-proof for our customers."

Construction of GNA I started in January 2018 and this plant began its commercial operation in September 2021. Once GNA II

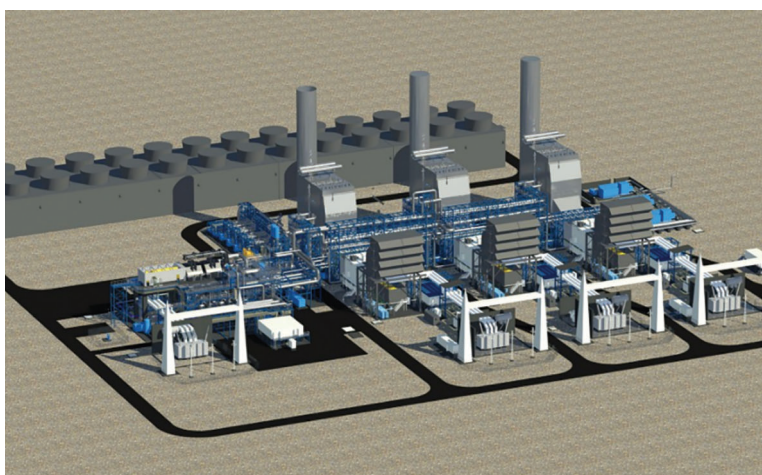
will be onstream, the two plants will have a combined capacity of 3 GW which is enough electricity to cover the needs of some 14 million households in regions like Espírito Santo, Minas Gerais and Rio de Janeiro.

License to build up to 6.4 GW capacity

A second phase will see the addition of further gas-fuelled power projects under the environmental license for 6.4 GW owned by the project company Gás Natural Açu (GNA). Siemens Energy will build the plant together with its consortium partner Andrade Gutierrez who is responsible for civil works, the infrastructure and the erection works.

For Siemens, the GNA II pro-

ject will see the first application of a HL class gas turbine in Brazil. For the GNA II power unit, Siemens Energy will deliver the entire power island, consisting of three HL-class turbines, one steam turbine, four electric generators and three heat recovery steam generators (HRSG), as well as instrumentation and control systems. The contract includes long-term O&M based on diagnostics by the Remote Operation Center in Jundiaí, São Paulo.



Render of GNA II at Port of Açu, Brasil

Wärtsilä to supply three gas-fired balancing plants (150 MW) to Brazil

Wärtsilä will supply three power plants (150 MW combined) under a contract awarded by the Brazilian energy minister in a reserve capacity auction. The orders were placed in the fourth quarter by companies held by BTG Pactual Asset Management, and Wärtsilä said the engines the gas-fuelled plants are scheduled to start operations in April 2022.

Under the Brazilian Reserve Capacity Auction, the state is contracting reserve energy with the aim of ensuring system reliability for the upcoming years. Hydro power currently covers most of Brazil's electricity needs, but se-

vere drought period in recent years have increased the risk of blackouts. The energy ministry hence set up an auctioning scheme that rewards operators of fast-start thermal power plants to make capacity available at short notice, if and when needed.



One of three emergency power units will be built next to UTE Luiz Oscar Rodrigues de Melo

The three gas engine-fired power plants will be delivered on EPC basis, and will be installed near three existing thermal plants in Brazil's south-eastern Espírito Santo state – notably UTE Luiz Oscar Rodrigues de Melo and UTE Viana 1, as well as a new power plant UTE

Povoação 1.

The EPC contract stipulates the delivery and installation of altogether 16 fast-starting and flexible Wärtsilä 20V34SG gas engine gensets. These fast-ramp engines are providing plant efficiency levels of up to 50% in simple cycle, and up to 54% in combined cycle mode.

"Our presence in Brazil is long and solid. With these projects we are approaching the important milestone of 3 GW of installed base in the country," commented Håkan Agnevall, Wärtsilä president and CEO.

To date, Wärtsilä has delivered 2.7 GW of power plant capacity in Brazil, of which 739 MW are currently covered by long-term service agreements. Wärtsilä has also converted 275 MW of oil-fuelled capacity in Brazil to run on cleaner-burning natural gas.

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