Gas to Power Journal
Peakload Power and Energy Storage

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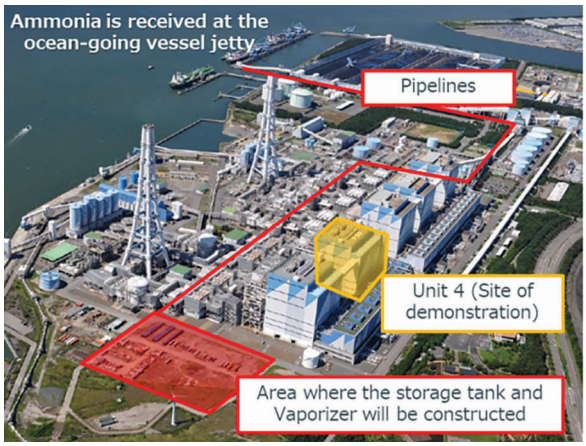
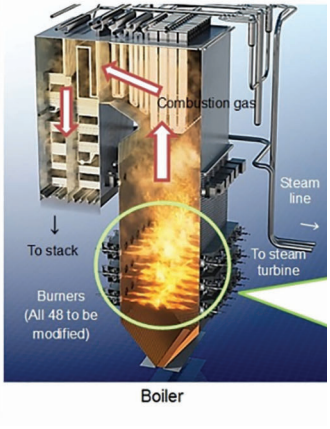
MHI to push ammonia co-firing beyond 50% at JERA's power stations

Mitsubishi Heavy Industries (MHI) will get Japanese government funding to develop a novel technology that will increase the rate of ammonia co-firing at boilers in JERA's 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.





Scheme of ammonia co-firing at JERA's 1 GW Hekinan power plant

A grant for JERA-MHI's project to develop an ammonia single-fuel burner has been accepted under Japan's Green Innovation Fund program of the New Energy and Industrial Technology Development Organization (NEDO).

Funding for the project will be made available for an 8-year period from financial year 2021 to financial year 2028. Within the first four years of the project, JERA and MHI have committed to develop a new burner capable of single-fuel ammonia combustion and draw up a master plan for equipment to demonstrate its use in actual boilers.

Based on the results, the two companies will decide whether to install the burners at JERA's coal-fired boilers made by MHI. For the actual plant demonstrations, the two partners are now working on verifying a novel technology to co-fire at least 50% ammonia at two power plant units with different boiler types. The test runs are due completed in early 2028.

Tests underway at Hekinan power plant

In June 2021, JERA already announced it will demonstrate a 20% ammonia co-firing rate at Unit 4 of JERA's 1 GW Hekinan thermal power station in fiscal year 2024.

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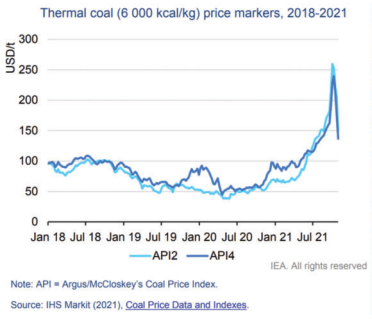
Rebound in coal-burn set to revers once LNG prices retreat; IEA says

Coal has staged a surprise return in the global power generation market in the face of sky-high LNG prices, but phenomenon will be short-lived, analysts at the International Energy Agency (IEA) reckon. A big part of the recent switching from gas back to coal is forecast to reverse as gas prices retreat from their 2011 and early 2022 highs.



The amount of electricity generated worldwide from coal surged by an estimated 9 percent to a new record high in 2021, analysts said, forecasting this strong growth potentially puts global coal demand and price on course for an all-time high this year.

The Argus/McCloskey's Coal Price Index11 (API) 2, which tracks cost, insurance and freight (CIF) prices in Europe, began climbing in June 2021. A supply shortage Europe pushed up gas prices so high that they are fully offsetting the effect of carbon pricing which renders coal attractive.

"Although carbon prices have reached record highs of €80 per tCO2, rising gas prices are provoking a power generation switch, back from gas to coal generation," analysts said, suggesting that "taken together, limited emissions allowances and tight coal and gas supplies are creating a positive feedback loop."

But coal's latest surge will be short lived given that the rising price tag on CO2 emission will soon make progressive power generators in favour cleaner-burning natural gas over thermal coal. "After its brief rebound in the United States and

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AGENDA

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Working together with the Japanese manufacturer IHI Corp, JERA has built an ammonia storage tank and vaporizer, while IHI's role is to develop the burners to be used in the demonstration. Different materials have been tested and evaluated at Unit 5 of the Hekinan plant from August to December 2021.

Japan-made catalysts to rival Haber-Bosch technology

Together with Chiyoda and Tokyo Electric, JERA is also undertaking research on catalysts that will help enhance the use of ammonia in power generation. The new ammonia synthesis process/facilities are meant to compete with Haber–Bosch based technologies by utilizing lower temperature and pressure synthesis catalysts.

Once proven in Japan, MHI and Chiyoda be able to sell the novel technology to their international customer base. JERA, Japan's largest power producer, is aiming for net zero CO2 emissions by 2025, through efficiency measures and plant retrofits. ■

US fuel costs forecast to keep rising in 2022, burdening heavy industry

Fuel costs in the US will keep rising in 2022, analysts say, putting more pressure on electric power generators and offtakers. America's energy-intensive industry was already hit by a 97% hike in average electricity prices to $45/MWh in the Midcontinent ISO market in late 2021, and a 37% increase at SP15 hub in California's CAISO market.

Gas prices nearly doubled over the course of last year due to freezing temperatures in February and shift recovery in LNG demand in Asia starting from August which pushed up US LNG exports. At Henry Hub in Louisiana – the US benchmark for gas prices and largest trading hub – wholesale spot prices averaged $3.89 per million British thermal units (MMBtu) in 2021, almost doubling from the 2020 average, according to data from Refinitiv.

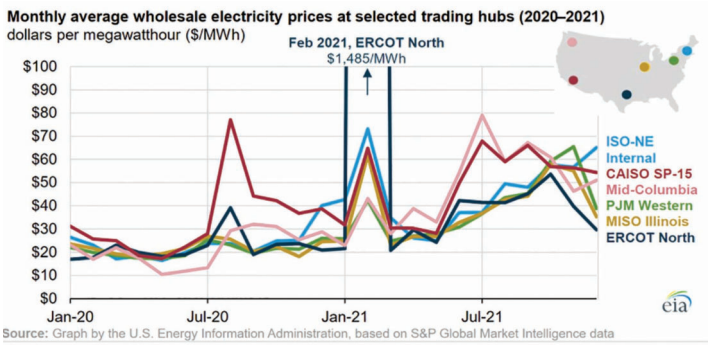
Natural gas often acts as the marginal fuel for power generator, hence the steep rise in gas and LNG prices during the second half of last years has hit consumers hard. According to US government data, the delivered cost of natural gas to electricity generators grew from $3.19/MMBtu in January 2021 to an estimated $5.04/MMBtu in the fourth quarter of 2021. Most of that price increase was factored into wholesale electricity prices and handed through to end-customers.

Cold freeze in February sent prices soaring

Freezing weather in February 2021 sent natural gas prices soaring throughout the US which propelled up electricity markets at other wholesale markets besides Texas. February wholesale electricity prices averaged $42/MWh in the PJM Interconnection market, which serves the mid-Atlantic states, and $73/MWh in ISO-New England.

Prices were especially volatile last year in the Electric Reliability Council of Texas (ERCOT) market where extreme cold temperatures restricted the flow of natural gas for power generation, and many wind turbines were frozen which pushed up hourly electricity prices in the day-ahead market.

Between February 14 and February 19, hourly wholesale prices at the ERCOT North trading hub exceeded $6,000 per MWh 70% of the time. For the month of February, the Texas wholesale electricity price averaged $1,485/MWh, according to US government data. ■



Source: Graph by the U.S. Energy Information Administration, based on S&P Global Market Intelligence data

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the European Union in 2021, coal demand will resume its decline through 2024," the IEA anticipates. The rapid build-out of wind and solar energy sources, thanks to falling capital costs, is also eating into the market share of coal generation.

China counts on coal

While advanced economies strive to decarbonise by phasing-out coal power, the opposite holds true in fast-growing Asian countries – particularly China. Power generation in China alone is responsible for almost one-third of global coal consumption.

Despite the pandemic, China's share of global coal consumption rose further last year to 53% and India's to India 12%, meaning that both countries together account for roughly two-thirds of world coal use.

"The importance of China in the world coal market cannot be overstated," the IEA report declared, explaining: "No other sector in any other country – or any other fuel – has a comparable influence on global trends."

The amount of coal China consumed for power generation increased 2.2% to 2,433 million tons. Chinese coal consumption for power generation was increasing drastically in 2021 and into 2022.

Covid-related dip in demand

Owing to wide-spread lockdowns at the height of the Covid-19 pandemic, the total global coal consumption fell 4.4% in 2020, down to 7,456 million tons. Coal-burn dropped 4.2% largely due to lower electricity consumption by industry and the overall economic slowdown.

Once lockdowns were lifted, notably in China, matters revered. "A 6% rebound was raising coal consumption to 7,906 million tons in 2021, similar to the 2010 increase that followed the global financial crisis," IEA analysts commented. ■

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Energy-hungry Asia to see 8% electricity demand growth in 2022

Building on Asia's booming electricity demand over the past 12 months, growth is expected to exceed 8% in 2022. "Fears over both Omicron and a collapse in China's real estate sector are overblown," says WoodMac's head of Asia Pacific Power & Renewables, Alex Whitworth. It's rather that China's resilient manufacturing sector and strong export growth will keep driving up demand, along with prices of coal and LNG.

Spiralling energy demand in China would increase the risk of shortages in the supply of thermal coal and natural gas, which already became apparent over the summer during the fast recovery of the Chinese manufacturing sector from the Delta-variant of the coronavirus.

According to Whitworth, the biggest risk to power demand comes from high gas and power prices, with most consumers in Asia having still not felt the full impact of rising electricity costs.

Exceptionally high gas and power prices, in fact, are seen as the biggest risk to Asia's wider economy as analysts believe "most consumers in China, India and other fast-growing Asian markets have not yet felt the full impact of rising electricity costs."

2022 – a year of reckoning

"For the region's major LNG importers, such as Japan, South Korea, Taiwan and coastal China, 2022 will be a year of reckoning. Meanwhile, those markets that rely on a higher share of coal or renewables, including China, India, Indonesia and Australia, will be insulated somewhat," commented WoodMac's head of Asia Pacific Power & Renewables, Alex Whitworth.

Corporates, especially energy-intensive industries, have been burdened by spiralling costs for electricity, heat and other raw materials. At the same time, they have to comply with ever-more stringent environmental rules and policies that favour renewable energy sources or clean fuels like hydrogen over traditional thermal fuels.

Most of Asia's corporates have outlined energy transition goals, and some have gone further to set out strategies and provide capital guidance.

"2022 will be a tipping point on the back of more ambitious pledges at COP26 as strategies materialise into investment decisions," reckon WoodMac's directors for corporate research, Kavita Jadhav and Andrew Harwood. Having evaluated a multitude of corporate guidance, they see 2022 shaping up to be a transitional year as decarbonisation takes a firm hold.

Corporates at a tipping point

The heads of China's major corporates will have to make major decisions next year in terms of whom to procure their electricity and fuels from. "We could see a doubling of spend by Chinese NOCs in 2022, for example, from the current US$4 billion guidance. Greater country-level ambition and target setting for 2025-30 will bring forward investments," Jadhav and Harwood commented. Based on WoodMac's emissions benchmarking tool, Chinese NOCs represent up to a fifth of global (Scope 1 and 2) emissions from 2022-30 – meaning there is still much room for improvement.

LNG-fuelled power plant in Japan

At COP26, the UN Climate Summit held in Glasgow in November, there was a rare reprieve in tensions between the US and China. A climate deal was signed in a last-minute action by the heads of both states, but analysts warned that if the political situation worsens again they could cause Chinese state-owned companies to "turn inwards and phase down climate cooperation."

In 2021, the New York Stock Exchange (NYSE) delisted CNOOC, and the national oil and gas company is now in the process of listing on the Shanghai stock exchange along with its existing Hong Kong listing. "A reduction in ownership from global investors lowers transparency and financial disclosure on climate risk and slows capital flows towards the energy transition," analysts warned. ■

EU countries unlikely to derail Brussels' nuclear and gas green-washing

European Commissioners have given EU member states time until January 21 to react to the contested Taxonomy, which labels fresh investment into gas and nuclear power as "climate friendly." The scheme can only be stopped if at least 20 EU countries oppose it, though this is unlikely as France and Poland want new small-scale nuclear reactors and Germany needs more flexible gas generation.

Keen to decarbonise the European energy sector, the Commission had proposed to classify investment into new small-scale nuclear power plants as "green" and "carbon neutral" if they will be built according to latest technology standards and have a plan for how to handle the radio-active waste.

Nuclear is meant to be included in the EU's green taxonomy

French-German spat over sustainability

Germany's new government struggles to align the financial sector with more stringent emission reduction targets while adhering to European guidelines. Though the Green Party – now part of Germany's ruling coalition together with the Social Democrats and the Liberal Democrats – clearly opposes new nuclear power but may be willing to compromise if Brussels will also classify investment in new gas-fired power stations as "climate friendly", at least for an interim period. Gas will be vital to help Germany avoid energy shortages in the face of the nearly simultaneous exits of coal and nuclear.

France, as well as several Eastern European countries, want to build a series of small-scale nuclear reactors to ensure stable electricity supplies as markets need to absorb growing volumes of inherently intermittent electricity from wind and solar PV installations.

Most Germany policy makers, in contrast, oppose such proposals and remains committed to its unilateral exit of nuclear energy. The Atomic Energy Act stipulates that the last reactor generating electricity in Germany will have to shut down by 2022 at the latest. ■

Uniper draws down multi-billion credit line to shield against high prices

Soaring commodity prices have propelled up Uniper's margin requirements, forcing the German utility to fully draw down a €1.8 billion credit facility with KfW, one of its core banks. Fortum, its Finish parent company, also provided Uniper with up to €8 billion intra-group financing to shield against what it calls "very volatile markets with unprecedentedly high prices."

During 2021, the European gas prices have risen up to 1,000% and have, together with power prices, been at unprecedented levels in December. In these challenging markets, Uniper strives to ensure reliable deliveries to its customers and hence hedges its asset position with forward commodity sales, which are often subject to margining payment.

When commodity prices increase, the mark-to-market value of those deals decline, which triggers additional margining payments for Uniper. On the contrary, when the underlying gas and power positions go into delivery or commodity prices decline, the margining payments are returned to Uniper, the company explained.

Keen to calm investors, Uniper said higher commodity prices not only led to "temporarily higher margining requirements" but at the same time increased the value of its underlying gas and power assets. "Therefore, our structural earnings prospects are not adversely impacted by higher prices," a company spokesman pointed out.

Affected by coal phase-out

Uniper plays a central role in ensuring security of supply in the European energy sector. It owns and operates a total of 34 GW power generation capacity, with most plants situated in Germany, the UK, Sweden and the Netherlands. With its broad thermal power base, Uniper is severely affected by the German coal exit which the new coalition government now seeks to push through by 2030 – in eight year's less time than initially agreed.

This puts further pressure on generators to speed up the clean energy transition. But "Uniper is ahead of its own announcement on coal phase out," COO David Bryson said, specifying around 2,500 MW of hard coal capacity can be withdrawn from the market ahead of schedule.

The Staudinger 5 hard-coal-fired power plant will 2023 cease commercial electricity production and has to be decommissioned by 21 May at the latest. It was one of three power plants to be awarded a contract – for 510 MW. The regulator's positive decisions for Heyden 4 (1st auction: 875 MW), Wilhelmshaven 1 (second auction: 757 MW), Scholven C (3rd auction: 345 MW) and now Staudinger 5 alone will enable Uniper to remove a total of 2.487 MW (net) of hard-coal capacity from the market ahead of schedule.

By phasing out hard coal, Uniper will save about 18 million metric tons of CO2 per year. The company's strategic plan calls for the decommissioning of hard-coal-fired power stations with 2,900 MW capacity combined by the end of 2025 at the latest.

New natural gas-fuelled power station, co-fired with hydrogen or ammonia, as well as wind and solar power will have to make up for lost coal power capacity. Investment in green energy will be substantial in the years to come, not just for Uniper but for all of Europe's major utilities. ■

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

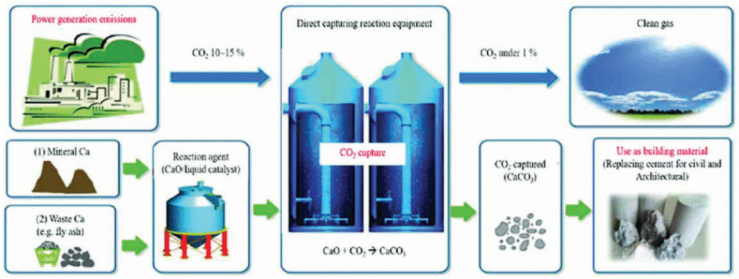
Carbon capture and utilisation (CCU) only make sense together with direct-air-capture technologies. Hydrocarbons will be needed even in a CO2-neutral economy – whether in artificial paraffin or for plastics – analysts at Germany's federal environment agency (UBA) say, hence "future carbon cycles can 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 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 industry 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. ■

ESG Clean Energy files new patent applications for Carbon Capture tech

ESG Clean Energy has applied for new patents on capturing CO2 from small-scale gensets while producing water or recycled plastic. The US-based company is about to complete its first 4.2 MW plant that utilizes these technologies to feed electricity into the local grid and provide distilled water from the carbon by-products.

If approved, the new patents will help ESG to better protect its technological innovations. "It will also allow us to continue advancing our technology as we develop our first clean, net zero carbon power generation systems," ESG President Nick Scuderi commented.

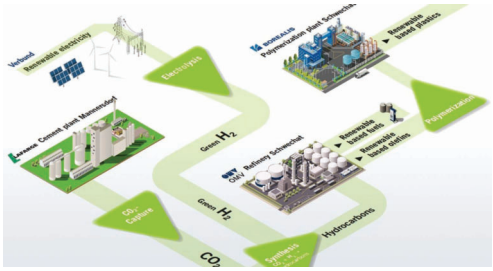
Net Zero energy from conventional gas engine

The innovative ESG system can create a Net Zero carbon outcome from a conventional, natural gas, internal combustion engine without loss of efficiency.

Exhaust gas contains a lot of water vapor and CO2 as by-products of the combustion process. By separating those elements, the ESG system can produce distilled water - and other commodities such as urea, methanol, and recycled plastics - while capturing close to 100% of the CO2.

Applications of the new system are in plastics recycling and nitrogen removal in the chemical industry. Nitrogen can cause algae blooms in wastewater treatment plants and is a risk to human health, so its removal has become an emerging, worldwide concern.

In the power sector, the system makes microgrids work more reliable and sustainable, or to provide large data centres, or crypto mining operations with clean low-cost energy. ■



Wärtsilä invests another €1m in CO2 direct air capture start-up

The Finish energy and marine technology group Wärtsilä has agreed to provide another €1 million in seed funding to Soletair Power Oy, a Finish start-up focussed on Power-to-X. Soletair developed a new concept to capture CO2 from the air and convert it into a synthetic renewable fuel that can be used for power generation.

Wärtsilä's latest investment comes on top of €500,000 made in 2019, and allows Soletair Power to scale up the scale up the manufacturing of its CO2 capture solution and increase its global sales efforts. At the same time, the investment gives Wärtsilä's access to decarbonisation technology, and the capture and utilisation development of CO2.

First CO2 air capture with building integration

Soletair's technology is the first in the world with building integration. "The solution turns buildings into carbon-sinks that support cities going carbon neutral;" explained Matti Rautkivi, New Business Director at Wärtsilä Energy.

Direct air capture of CO2 is deemed an "essential element of the world's efforts towards decarbonisation." In addition to producing synthetic renewable fuels for electric utilities and transport, carbon captured from air in can be used for industry applications, such as in the food industry. ■

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Nord Stream 2 "unlikely" to be certified before summer, BNetzA says

Unphased by market pressure, the German regulator BNetzA is holding back approval for Nord Stream 2 – one of Europe's most controversial gas pipelines. The regulator "preliminary halted" the certification process until Swiss-based Nord Stream AG has founded a subsidiary under German law to own parts of the pipeline – a request set to delay matters until summer 2022.

Critics warn the German regulator and EU policy makers may ultimately derail the multi-billion pipeline project. This move would exacerbate the risk of gas supply shortages in German at a time when the country simultaneously exits coal and nuclear power.

Built at a cost €11 billion and over a time of three years, Nord Stream 2 was meant to start supplying first gas from Russia to Germany before Christmas. By October 2021, already, the first pipeline leg was filled with gas and the second leg was ready to start deliveries in late December – but Gazprom was not permission to do so.

Playing for time

On the contrary, BNetzA seems to be playing for time as the regulator insists it will not continue its approval process until Nord Stream AG has transferred all financial assets on German soil and key personal to the new subsidiary. This new entity has to fulfil the unbundling requirements of an independent transmission operator as set out in sections 10 to 10e of the German Energy Industry Act (EnWG)and submit documentation, and evidence to the BNetzA's ruling chamber.

Once all preconditions have been met, BNetzA will scrutinize the pipeline within its legally permitted timeframe of 4 months. The regulator said its draft decision will then be transmitted to the European Commission.

The state gas companies of Poland and Ukraine – PGNiG and Naftogaz – were notified and approve of these proceedings. Both countries have been the most outspoken critics of the Russian gas interconnector to Germany through the Baltic Sea. ■

GE transformers ordered for Dogger Bank and reactive power in Germany

GE's Mistral 14 MVA power transformers have been ordered to grid-integrate Dogger Bank – Europe's largest offshore wind farm – built in three 1.2 GW phases off the coast of northeast England. In addition, the German TSO Amprion bought two 340 MVA transformers for a synchronous condenser to deliver reactive power and grid inertia.

Situated some 130 kilometres off northern England, Dogger Bank will be capable to power over 6 million British homes once fully complete in 2026. To grid-integrate such large volumes of inherently intermittent wind power, the GE-Mistral-14 – a 14 MVA – 66 kV small power transformer – will play a vital role. Under a contract with SSE, one Mistral-14 will placed be in each of the 95 GE Haliade-X turbines at the first phase A of the windfarm. Follow-up transformer orders are likely for project phase B and C, not least because GE is delivering all turbines for Dogger Bank wind farm.

In Scotland, SSE ordered two 1,200 MVA 400 kV auto transformers for its Kintore substation to upgrade the local grid from 275 kV to 400 kV. Installation of the transformers at Kintore is slated for completion within the fourth quarter of 2022.

In Meppen, northern Germany, TSO Amprion ordered two 340 MVA large power transformers for a synchronous condenser installation at their plant. The transformers will be delivered in the first quarter of 2023 and will help deliver inertia and reactive power for greater grid stability.

Solutions range from phase-shifting to HVDC

The product line of GE's power transformers includes solutions such as phase-shifting, static var compensator (SVC), high-voltage direct current (HVDC), low maintenance and reactors, as well as more environmentally friendly power transformers featuring biodegradable vegetable oil. Voltages range from small (5 MVA) to medium and ultra-high voltage (1,200 kV AC and ±1,100 kV DC) up to very large power ratings (2,750 MVA).

Outside Europe, GE recently won a contract from the Nigerian branch of MBH Power for seven 150/187.5 MVA 330/132/33 kV auto transformers and two 100/125 MVA 132/33 kV power transformers. The devices will be delivered in October 2022 with a view to stabilising the supply of the Nigeria's national transmission company and help meet the country's growing energy demand. ■

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