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Dynamic duo

Solar-plus-storage is becoming ubiquitous but what will the hybrid projects of the future look like? *Page 12*

New energy models

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The UK could see another 25 GW of offshore wind built in waters off the Scottish coast – more than half of it using floating turbines – after the successful 'ScotWind' leasing round. *Page 7*

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China will install hundreds of megawatts of wind and solar this decade. Joseph Jacobelli outlines the key initiatives and policies behind this herculean task. *Page 14*

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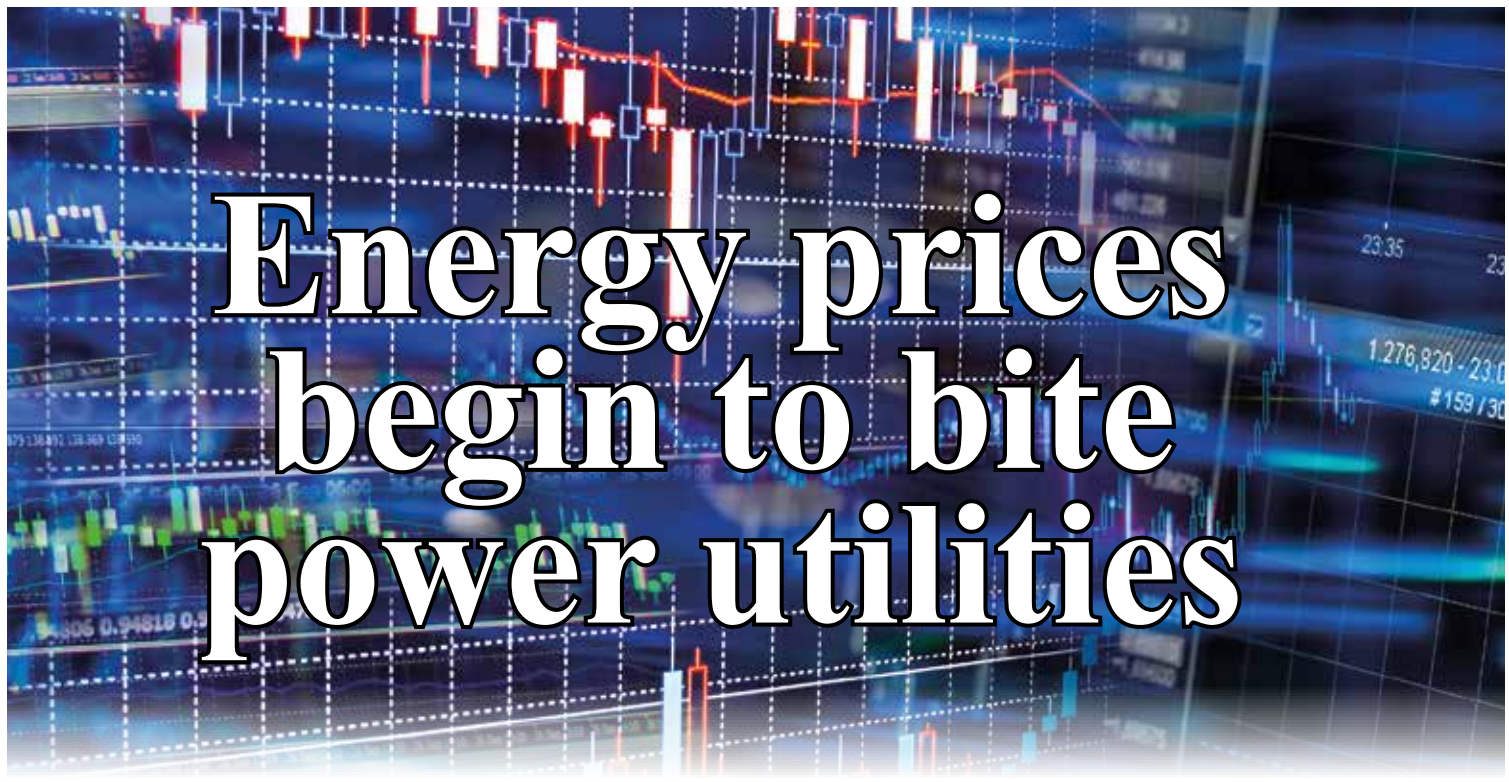
As more homes turn to renewable energy sources, like solar panels, remote monitoring and managing low- and medium-voltages on the grid becomes increasingly challenging for network managers. *Page 15*



Energy prices begin to bite power utilities

Spiralling gas and electricity prices have forced several of Europe's largest utilities to seek lines of credit to cover hedges for future energy sales. **Junior Isles**

Some of Europe's biggest energy utilities are beginning to show the first signs of strain caused by record gas and electricity prices.

In January Uniper, RWE and Steag were forced to seek lines of credit to cover hedges taken out for future sales of gas and electricity.

Uniper, established in 2016 as a spin-off of the fossil fuel assets from E.On, said it has secured €8 billion of credit from its majority shareholder, Finnish power company, Fortum, and €2 billion from German state bank KfW. KfW said it had granted Uniper the credit line in order to secure "liquidity in this special situation at the government's request".

Uniper says the credit line from KfW is a back-up facility in case of "further extreme commodity market developments" – a distinct possibility if there is a cold snap in Europe or if Russia invades Ukraine.

Fortum, which owns 76 per cent of Uniper, described the new credit facilities as "precautionary measures to secure additional liquidity and financial flexibility primarily for the winter season".

It is the second time in less than six months that the company has had to seek additional financing, highlighting the effect that surging energy costs are having on utilities. Uniper is among Europe's largest electricity generators with 34 GW of capacity, and is also a big gas supplier.

Uniper said in November it had sold 90 per cent of its German power for 2023 at €51/MWh, leaving it heavily exposed as the price soars far beyond that level, with German power futures for that year settling on January 8th at €137.3/MWh.

Other German energy companies, including RWE, STEAG and EnBW, said that they had taken similar steps to ensure they had sufficient credit to weather the volatility in the European energy market.

RWE said that "strong price fluctuations naturally lead to temporarily high liquidity requirements", and that it had "made provision for this" through "credit lines and other financing instruments".

STEAG, meanwhile, said it has secured at least €100 million ($113 million) in extra funding to shield it from the skyrocketing prices.

"STEAG is able to actively participate in market activities, also in the current market situation. We found suitable partners for handling our forward transactions at an early stage," it said in a statement. Unlike Uniper,

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STEAG said it does not plan to turn to KfW for help.

Not all big utilities have been hit to the same extent as Uniper, either because they have large retail businesses or, in the case of RWE, have offsetting variation margin inflows from hedging carbon emissions related to its power plants that burn lignite.

Speaking to the *Financial Times*, Lueder Schumacher, analyst at Société Générale, said: "As the CO_2 price rose another 31 per cent in the fourth quarter of 2021, the pressure on working capital should be significantly less for RWE."

He warned, however, that he would "be surprised if everybody in the market who needs access to credit lines will actually get it".

The rush for credit follows an unprecedented rise in natural gas and power prices. European gas prices have surged more than 400 per cent over the past year, as demand rebounded following the pandemic and additional cargoes of liquefied natural gas went to Asia.

At the same time, Russia's Gazprom has restricted sales only to those covered by long-term contracts, while letting its storage facilities in Europe drop to unusually low levels – a move that many believe is a deliberate attempt by Russia to win approval for the final connection of the controversial Nord Stream 2 gas pipeline.

The IEA's Fatih Birol, says Russia is choosing not to boost gas supplies

Fatih Birol, Executive Director of the International Energy Agency (IEA), said that Russia could boost gas supplies by at least a third but is choosing not to.

"There are strong elements of tightness in the European gas market due to Russia's behaviour," he said. "The current storage deficit in the European Union is largely due to Gazprom."

The IEA calculates that Russian supplies to Europe were down 25 per cent from 2020 levels in the fourth quarter of 2021, and were 22 per cent below pre-pandemic levels.

Russia, however, rejects those allegations and accused the IEA of trying to "politicise the issue".

Deputy Prime Minister Alexander Novak, told state television: "Neither Russia nor our main exporter Gazprom have anything to do with this." Russia has "delivered significantly more" to clients, such as Germany and Turkey, that had exhausted their contracted limits.

Novak blamed "the short-sighted policy of the European Union and European Commission, which for many years has deliberately moved away from long-term contracts, shifting its energy sector toward reducing dependence on Russia".

Price volatility will continue unless there is faster change, says IEA

- Wholesale electricity price index up 64 per cent from 2016-2020 average
- Higher investment needed in low-carbon energy technologies

Junior Isles

The strong rebound in energy demand following the pandemic could result in continued market volatility and record power plant pollution unless countries change how they generate electricity, says the Paris-based International Energy Agency (IEA).

According to the January 2022 edition of the its semi-annual 'Electricity Market Report', global electricity demand surged in 2021, creating strains in major markets.

The report recorded the steepest ever increase in electricity demand last year, which triggered blackouts in major economies and led to historic energy price highs and record carbon emissions.

According to the IEA, this will continue for another three years, with serious consequences for consumers and economies, unless there is a faster structural change to how electricity is produced.

The IEA's price index for major wholesale electricity markets almost doubled compared with 2020 and was up 64 per cent from the 2016-2020 average. In Europe, average wholesale electricity prices in the fourth quarter of 2021 were more than four times their 2015-2020 average. Besides Europe, there were also sharp price increases in Japan and India, while they were more moderate in the US where gas supplies were more stable.

"Sharp spikes in electricity prices in recent times have been causing hardship for many households and businesses around the world and risk becoming a driver of social and political tensions," said IEA Executive Director Fatih Birol.

He added: "Policymakers should be taking action now to soften the impacts on the most vulnerable and to address the underlying causes. Higher investment in low-carbon energy technologies including renewables, energy efficiency and nuclear power – alongside an expansion of robust and smart electricity grids – can help us get out of today's difficulties."

Driven by the rapid economic rebound, and more extreme weather conditions than in 2020, including a colder than average winter, last year's 6 per cent rise in global electricity demand was the largest in percentage terms since 2010 when the world was recovering from the global financial crisis. In absolute terms, last year's increase of over 1500 TWh was the largest ever, said the report.

Electricity produced from renewable sources grew by 6 per cent in 2021, but it was not enough to keep up with demand, while coal fired generation increased by 9 per cent, gas fired generation grew by 2 per cent, and nuclear increased by 3.5 per cent.

In total, carbon dioxide emissions from power generation rose by 7 per cent, also reaching a record high, after having declined the two previous years.

Birol said: "Emissions from electricity need to decline by 55 per cent by 2030 to meet our Net Zero Emissions by 2050 Scenario, but in the absence of major policy action from governments, those emissions are set to remain around the same level for the next three years,"

For 2022-2024, the report anticipates electricity demand growing 2.7 per cent a year on average, although the Covid-19 pandemic and high energy prices bring some uncertainty to this outlook.

Renewables are set to grow by 8 per cent per year on average, serving more than 90 per cent of net demand growth during this period. The IEA expects nuclear-based generation to grow by 1 per cent annually during the same period.

UK readies hydrogen grid as gas crisis deepens

Britain's network of gas pipes will be ready to start delivering hydrogen to homes and businesses around the country from 2023, according to the Energy Networks Association (ENA).

In its recently published 'Britain's Hydrogen Blending Delivery Plan' the ENA sets out how all five of Britain's gas grid companies will meet the government's target for Britain's network of gas pipes to be ready to deliver 20 per cent hydrogen through its pipelines as a replacement for up to a fifth of the natural gas currently used.

It will also mean that Britain's fleet of gas fired power plants will be able to use blended hydrogen to generate cleaner electricity. Power companies are also calling for the British government to double its domestic 2030 hydrogen production target from 5 GW to 10 GW, to ensure that as much hydrogen as possible is produced from domestic sources, to better protect homes and businesses from international gas market changes.

The plan builds on the progress made by gas network companies through the HyDeploy project, which has demonstrated that blending hydrogen with natural gas is feasible and safe. The project began blending hydrogen into the public gas network in Winlaton, Gateshead, in summer 2021.

"Whether it be heating our homes, powering our businesses or generating cleaner electricity, hydrogen will help drive up our energy security, while driving down our carbon emissions," said David Smith, the ENA's Chief Executive.

The news came as the International Energy Agency reported that carbon emissions from the UK electricity sector jumped by a fifth in 2021, the first rise in almost a decade, largely due to a 17 per cent rise in gas fired power.

With gas prices at record highs, the transition to hydrogen has become even more attractive. In a separate report published last month, the International Renewable Energy Agency (Irena) says that Europe's gas crisis could speed the transition to clean energy and the adoption of green hydrogen as a viable alternative to oil and gas.

"Price volatility has been a feature of the oil and gas system," Francesco La Camera, Director-General of Irena, told the *Financial Times*. "Moving to the new energy system, where hydrogen plays a significant role, brings us less volatility."

The report points out that the geopolitics of oil and gas, in which producer countries have the power to influence prices, would wane as new fuels including hydrogen become more dominant.

"Hopefully the geopolitics of energy in 2050 will be less important than they are now, because people will have less dependency on small markets that can really influence global energy markets in an unpredictable way that we have today," commented Elizabeth Press, Irena's Director of Planning.

EU green taxonomy proposal faces legal challenge

The European Commission is facing the threat of a legal challenge over plans to label investments in gas and nuclear as green.

Energy ministers from both Austria and Luxembourg have said they will pursue a lawsuit against the Commission over its so-called green "taxonomy" rules, while a Spanish Deputy Prime minister has said Spain might instead use its own green framework, excluding nuclear power and natural gas.

The anti-nuclear governments of Austria and Luxembourg have reportedly started preparations for a lawsuit against the Commission if the rules are approved in their current form. They argue that nuclear power, which has no carbon footprint but produces toxic waste with radiation risks, violates the EU's "do no significant harm" to the environment principle.

Leonore Gewessler, Austria's Green Energy Minister, told the *Financial Times*: "There's a solid and a strong argument to go to the European Court of Justice if the Commission decides to proceed and the taxonomy comes into force. We need to make sure that financial markets stay true to the alternatives of renewable energy."

The proposed EU taxonomy regulation categorises industries that generate about 80 per cent of the bloc's greenhouse gas emissions, in an attempt to help investors direct capital into sustainable economic activity. The labelling system would then be applied to financial products and green bonds, and guide EU government spending towards the climate transition.

Environmentalists have already criticised the EU over the draft plan and scientists hired by the Commission to help draw up the rules are also pushing for amendments.

According to a document seen by the *Financial Times*, the expert group that has helped to design the taxonomy over the past three years wants Brussels to deny a green label to electricity produced from natural gas that produces more than 100 grammes of CO_2/kWh.

The proposed new taxonomy rules has divided European member states, with pro-nuclear countries like the Czech Republic, France, Poland and Slovakia supporting the proposals, while the likes of Germany is aligned with Austria and Luxembourg in its anti-nuclear stance.

US plans grid upgrade to accommodate major renewables expansion

■ Grid needs may triple by 2050 ■ Solar expected to be half new capacity in 2022

Janet Wood

The US Department of Energy (DoE) has launched an initiative to upgrade and expand the US power transmission grid to accommodate a huge increase in renewables and facilitate President Joe Biden's target of 100 per cent clean electricity by 2035.

The 'Building a Better Grid' initiative also aims to make the country's aging grid more reliable and resilient to climate change impacts. It will leverage more than $20 billion in federal financing tools for the grid upgrades and work with local and state stakeholders to identify key projects.

The DoE said independent estimates calculate that electricity transmission systems will have to be expanded by 60 per cent by 2030 and possibly tripled by 2050. It also said that the interconnection queue waiting times for clean energy and storage projects are growing amid accelerated use of renewable electricity.

The speed of construction of new capacity was highlighted in new figures. They say solar, wind, and other renewable energy sources are now adding more than 2250 MW of new generating capacity in the US each month. The data were released recently by the US Federal Energy Regulatory Commission (FERC) and the US Energy Information Administration (EIA).

Solar (up 9.6 GW) and wind (up 8.5 GW) dominated US electrical generating capacity additions during the first ten months of 2021. With new hydropower (28 MW), geothermal (25 MW) and biomass (18 MW), renewables represented 83.6 per cent of all new generating capacity to the end of October, they said. New renewable capacity was more than five times greater than that of natural gas (3.5 GW) while new oil and coal capacity increased by just 19 MW and 11 MW, respectively. Renewables now provide 25.47 per cent of total US installed generating capacity and the US EIA believes increases will continue in 2022, especially for solar. It predicted recently that in 2022, almost half of an extra 46.1 GW of new utility-scale electric generating capacity in 2022, would come from solar, followed by natural gas at 21 per cent and wind at 17 per cent.

"The breathtaking pace at which solar and wind are adding new capacity explains why renewable sources combined have eclipsed the generating capacity of nuclear power and surpassed that of coal as well as whittled down the lead of natural gas," said Ken Bossong, Executive Director of the SUN DAY Campaign. "Conservatively, over the next three years, renewables should expand from about a quarter of the nation's generating capacity today to at least 30 per cent and probably more."

Costs rise for US's new nuclear project

The capital costs of two new nuclear reactors at Georgia Power Company's plant Vogtle site have more than doubled, according to recent figures.

The project cost was initially estimated at around $14 billion, but it now exceeds $30 billion and both units will be more than six years late in coming online, according to a report by the Institute for Energy Economics and Financial Analysis.

The Georgia Public Service Commission staff blames Georgia Power's construction schedules, described as "unreasonable and unachievable". The Commission says the corporate culture values production over quality, with high personnel turnover and high failure rates testing an unproven reactor design.

"The company was warned back in 2008 that using a new unproven reactor design from Westinghouse for the new Vogtle reactors was likely to lead to cost overruns and major schedule delays," said David Schlissel, the report's author and IEEFA's Director of resource planning and analysis. "However, the company challenged and the commission disregarded these warnings."

Georgia Power's customers have already paid more than $3.5 billion for the project since 2011 and the public service commission staff reportedly expects upfront payments will grow to $4 billion by the time the two units are completed.

East and west US states race to get offshore wind benefits

The state of New York has announced it will invest up to $500 million in offshore wind infrastructure to establish itself as the hub for offshore wind projects up and down the Eastern seaboard, according to a recent statement by governor Kathy Hochul. The state's investment is expected to attract private capital and spark $2 billion of activity.

Hochul promised investment in ports, manufacturing and supply chain infrastructure alongside New York's third offshore wind procurement round, which will be launched in 2022.

The round is expected to deliver at least 2 GW of new projects, supporting the state's goal of 9 GW offshore wind by 2035. So far 4.3 GW is in development and the state has begun planning an offshore wind grid and doubling storage deployment to at least 6 GW by 2030.

Meanwhile, the state of California has announced plans to allocate $2 billion from its 2022-2024 budget to back clean energy investments, including offshore wind and green hydrogen production.Governor Gavin Newsom plans to invest $45 million in offshore wind in 2022-2023, and $100 million to support green hydrogen. He also promised $380 million to promote investments in long-duration energy storage capacity.

Chile follows up 2021 capacity auction

■ Antofagasta a key region
■ Green hydrogen projects supported

Chile has published details of a new power auction, planned for mid-2022, which aims to contract 5250 GWh/y for 15 years. It is targeting a share of 60 per cent of renewables in power generation by 2035 and 70 per cent by 2050.

The country's National Energy Commission (CNE) said domestic and international companies will be able to participate and bid for contracts to supply power from January 2027 to December 2041. Participants have until 17 June to submit bids and winners will be announced on 4 July.

A similar power auction last September was eight times oversubscribed and closed with average prices 27 per cent lower than the country's auction in 2017.

As of November 2021, Chile had just over 5.8 GW of installed solar PV, most in the northern regions of Atacama and Antofagasta, according to figures from the Chilean Association of Renewable Energy and Storage (ACERA). Recently the government announced it would invest $400 million, in partnership with AES Corporation, to bring Chile's installed energy storage to more than 300 MW.

AES is already working on a 118 MW battery project in the Antofagasta region and in the same state Colbun has started construction works on the 778 MW Horizonte wind project. The $850 million wind farm is due to be operational in 2024.

Meanwhile Chile has begun to leverage its renewables resources and recently announced $50 million of investment in a Green Hydrogen Strategy.

It wants to have six 10 MW electrolysers in operation by December 2025 and it has selected projects in Antofagasta, Valparaso, Biobo and Magallanes. Most will produce green hydrogen, and some will use that to produce methanol or ammonia to diversify the use of hydrogen. This will "take advantage of the enormous potential that Chile has in renewable energy, both in the north and in the extreme south of our country," said Juan Carlos Jobet, Minister of Energy and Mining. The initiatives are distributed throughout Chile to support decentralisation, he said.

Jobet said that Chile's potential as a producer and exporter of green hydrogen would also help it decarbonise mining, transportation and agriculture.

Fitch places Chile with Brazil at the top of its regional hydrogen investment ranking, saying their "high rewards and lower risks [are] already translating into robust green hydrogen project pipelines".

Argentina turns to Chinese grid investment after blackout

After Argentina's capital city Buenos Aires suffered a blackout in January that left at least 700 000 people without electricity, the country has turned to China to finance an upgrade of the region's grid.

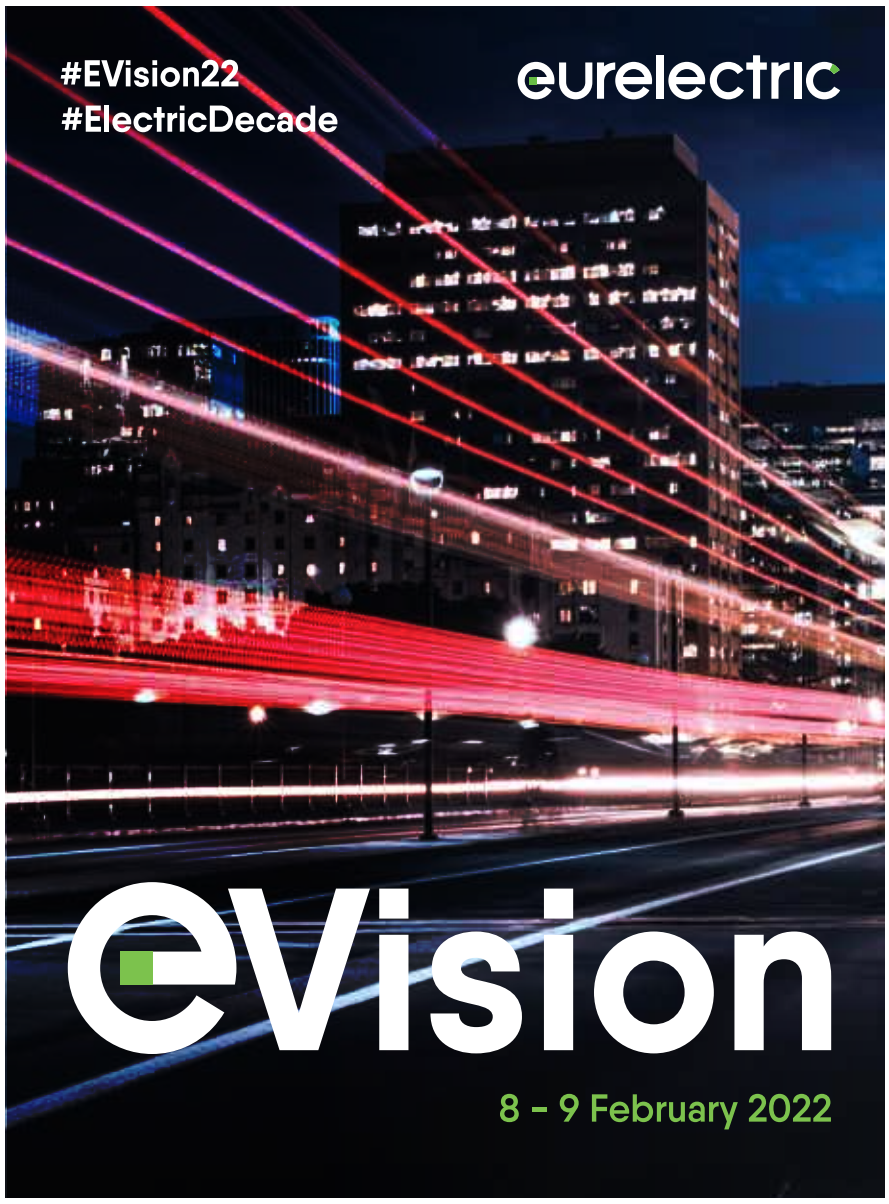
The blackout hit traffic lights, subway operations and purification systems for the area's drinking water supplier. It was blamed on hot dry weather, which has been exacerbated by the La Nina weather pattern. The result has been increased consumption, at the same time as lack of rainfall cut water levels to an almost 80-year low, affecting hydro generation.

In the midst of a heat wave and following criticism by the Secretary of Energy, Dario Martinez, of the previous administration's lack of investment in infrastructure, the Argentine government announced an agreement for $ 1.1 billion in Chinese financing for works to extend the power grid.

Martínez and Federico Basualdo, the Undersecretary of Electric Energy, met China Electric Power Equipment and Technology (CET) and CET Argentina to discuss construction of a new transformer and more than 500 km of high and extra high voltage power lines in Buenos Aires.

The expansion was said to be the "largest in the last 30 years", and would cost more than $1100 million.

"We are facing an increase in production and a heatwave. The energy we generate is enough, but we are facing a moment of higher demand. We have been four years without generating a new kilometre of line," said an official.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Japan includes cleaner coal in low-carbon drive

■ JERA to build coal-ammonia co-firing demo projects ■ Consortiums selected for Akita offshore wind power projects

Syed Ali

Japan is looking to reduce emissions from its coal fired plant while ramping up its renewables installed capacity, as the power sector looks to support the country's zero emissions targets.

Japan's biggest power generator JERA recently announced that it is planning three new demonstration projects, two aimed at using at least 50 per cent of ammonia along with coal at its power plants by March 2029 and another to develop new ammonia synthesis catalysts by March 2031.

Under its "JERA Zero CO_2 Emissions 2050" objective, JERA has been working to reduce CO_2 emissions from its domestic and overseas businesses to zero by 2050, promoting the adoption of greener fuels and pursuing thermal power that does not emit CO_2 during power generation.

Ammonia is used as a fertiliser and in industrial materials, but is also seen as a future energy source, along with hydrogen. It does not emit carbon dioxide when burned although its production produces emissions if it is made with fossil fuel. JERA said it would spend Yen69.2 billion ($597 million) on the development of the ammonia-related technology, with nearly 70 per cent covered by the government's green innovation fund.

JERA and IHI Corp began using small volumes of ammonia along with coal at JERA's Hekinan power station in central Japan last year as part of an effort to reduce the facility's emissions of carbon dioxide.

The current project runs for about four years through March 2025 with a target of achieving a co-firing rate of 20 per cent at a 1 GW coal power plant at Hekinan.

JERA, a joint venture between Tokyo Electric Power (TEPCO) and Chubu Electric Power, will also conduct a similar project with Mitsubishi Heavy Industries Ltd (MHI), developing a new burner by FY2024 and verifying co-firing of at least 50 per cent of ammonia at two power plants with different boiler types made by MHI by March 2029.

These two projects will cost Yen45.2 billion, Yen27.9 billion of which will be subsidised by the government fund, a JERA spokesperson said.

JERA, along with Chiyoda Corp and Tepco, will also invest Yen24 billion in another 10-year-long project to develop ammonia synthesis catalysts.

Meanwhile, Japan is continuing to accelerate its wind power programme, selecting three consortiums, all led by Mitsubishi Corp., as the operator for three offshore wind power projects in Akita, northern Japan, and Chiba, near Tokyo. The announcement made in late December, is the second set of results of government auctions for offshore blocks under a new law to promote wind power as Japan aims to boost renewable power capacity to help achieve its 2050 goal of becoming carbon neutral.

The three projects are scheduled to start operation between September 2028 and December 2030.

Cost of renewables rise but still gains on fossil fuelled power

Asia Pacific's renewable power bucked a historical trend of falling levelised cost of electricity (LCOE) and rose in 2021 but still gained ground against fossil fuel power, says Wood Mackenzie.

According to the global energy research and consultancy group, last year's power crisis caused fossil fuelled generation and renewables electricity prices to spike amidst strong demand and supply chain tightness. Spot market fuel prices averaged over the year pushed up costs of coal and gas power by 19 per cent and 46 per cent, respectively, making renewables (utility PV and onshore wind) appear more competitive. However, increased equipment and logistics costs meant that solar and wind power were also hit by cost inflation.

Wood Mackenzie senior analyst Rishab Shrestha said: "The average LCOE across Asia Pacific for new solar projects increased by 9 per cent to $86/MWh and for onshore wind projects by 2 per cent to $103/MWh last year.

"Renewables' supply chain bottlenecks are expected to ease in 2022 and beyond, and the respective LCOE will return to a declining trend."

Currently, renewable power costs in Asia Pacific are about 16 per cent more expensive on average compared to fossil fuel power costs over the project lifetime. India, China and Australia are the top three leaders with renewable power being between 12 per cent and 29 per cent cheaper than the lowest-cost fossil fuel, coal. Other major markets still have a significant renewables premium.

Shrestha added: "Interestingly, China is the only Asia Pacific market which has bucked the renewables premium cost inflation trend in 2021, supported by a mix of factors including rising fossil fuel prices, domestic manufacturing, zero-tolerance Covid policy, and its commitment towards climate change."

Wood Mackenzie forecasts that by 2030, electricity from renewables (mostly utility PV) will be at a 28 per cent discount to coal across the region. India, Australia and China remain low cost champions for renewable power with LCOE discounts ranging from 50-55 per cent. Both onshore wind and solar will be at a discount or at parity with gas and coal power in these markets. However, offshore wind LCOE in Asia Pacific will not be competitive against gas fired power (CCGT) until the 2030s, except for China which will hit this milestone in the early 2020s.

Vietnam leads ASEAN in capacity as renewables expand

Vietnam's total installed power capacity for 2021 hit 76 620 MW in 2021, 7500 MW higher than the previous year and the highest among ASEAN member states, according to state utility Vietnam Electricity (EVN).

Speaking at its end-of-year meeting last month, the company's CEO, Tran Dinh Nhan, also noted that the installed capacity of renewables hit 20 670 MW, up 3420 MW year-on-year and accounting for 27 per cent of the total.

Wind and solar power started to develop in Vietnam in 2011 and have boomed since 2017 thanks to the feed-in-tariff incentives (FIT). Last year, however, the sector faced bottlenecks that have prompted the government to consider various price mechanisms for wind power plants that did not meet the 31 October 2021 deadline for the incentive FIT.

In late December the government said it is now considering a tariff structure for all types of energy, based on which investors would negotiate power prices with EVN, said Nguyen Tuan Anh, Deputy Head of the Ministry of Electricity and Renewable Energy.

Many investors in renewable energy projects said they were unable to start commercial generation by the deadline because of Covid-19, and urged relevant agencies to quickly issue new price policies and mechanisms for them.

It is expected that the tariffs will be made public after the government rubber stamps the Power Development Plan VIII for 2021-30, which is still pending approval.

China could triple electricity generation to meet 60 per cent of the country's total energy demand under its 2060 carbon neutrality target, up from 23 per cent now.

In a rare assessment of the country's energy sector by an international oil company, Royal Dutch Shell said China needed to take swift action this decade to stay on track to reach the carbon neutrality target. Shell is one of the world's largest investors in China's energy sector, with businesses spanning gas production, petrochemicals and a fuel retail network.

China has outlined plans to reach peak emissions by 2030, but has yet to unveil any detailed carbon roadmap for 2060. Current plans to cut carbon emission include investing in a reliable, renewable energy system and demonstrating technologies that transform heavy industry through the use of hydrogen, biofuels and carbon capture and utilisation.

"With early and systematic action, China can deliver better environmental and social outcomes for its citizens, while becoming a positive force in the global fight against climate change," Mallika Ishwaran, Chief Economist at Shell International, said during a webinar hosted by the company's China business.

Shell expects electricity generation in China to triple to more than 60 EJ by 2060, up from 20 EJ in 2020.

Solar and wind are expected to overtake coal as the main sources of electricity in 2034 in China, up from 10 per cent today, and increase to 80 per cent by 2060, Shell said.

China is continuing to take huge strides towards these forecasted levels. Last month China Three Gorges Corporation announced that it is to spend $6.5 billion on three off-shore wind farms in Guangdong province, and in late December Beijing Jingneng Clean Energy Co Ltd said that it has initiated construction of 1 GW of wind and solar projects in Inner Mongolia with some energy storage capacity. One of the two projects, the 500 MW Abag Banner Project, will also produce hydrogen.

Notably, Shell said it expects hydrogen to increase to 17 EJ, or the equivalent of 580 million tons of coal by 2060, up from the current almost negligible level, adding that more than 85 per cent of hydrogen will be produced by electrolysis fuelled by renewable and nuclear electricity.

Hydrogen will cover 16 per cent of total energy use by 2060, with heavy industry and long-distance transport being the main users, the company added.

■ Sumitomo SHI FW (SFW) has entered into a collaboration agreement with China's Shanghai Power Equipment Research Institute (SPERI) for evaluating the feasibility of liquefied air energy storage, CRYOBattery™, technology. The collaboration involves conducting a study with two configurations, a 4-hour and an 8-hour storage, to determine the most optimal size for Binhai Power Station Energy Storage Demo project in Binhai Jiangsu, China. Both configurations consider 50 MW discharge power capacity.

Offshore wind pipeline expands as countries look farther out

■ Scottish waters to host 25 GW by 2030 ■ New auctions planned in western Europe

Janet Wood

The UK could see another 25 GW of offshore wind built in waters off the Scottish coast – more than half of it using floating turbines – after the successful so-called 'ScotWind' leasing round. The ScotWind winners aim to start delivering projects by the end of the decade.

Meanwhile offshore wind development is stepping up elsewhere in the UK and across Europe. EDF Renewables has joined project developer DP Energy for a 1 GW floating wind project dubbed 'Gwynt Glas' – part of the UK Crown Estate's ambitions for 4 GW of capacity in the Celtic Sea, announced in October 2021.

Scott Sutherland, EDF Renewables UK Head of Offshore Wind, said: "We firmly believe Gwynt Glas will be a catalyst for further supply chain growth across the UK, which is something we as a company are very supportive of… Floating offshore wind is an exciting new technology and will bring much needed inward investment, which can regenerate coastal economies and communities."

Elsewhere, the Republic of Ireland parliament has passed a bill that will simplify the issuing of permits to build offshore wind farms – described as the greatest reform of marine governance since the founding of the State. It now plans to open its first offshore wind auction late in 2022, the first step towards plans for 5 GW of offshore wind by 2030, and at least 30 GW in deeper waters after that date.

Meanwhile the Netherlands has announced that a tender for the Hollandse Kust (west) Wind Farm Zone, which can accommodate 1.4 GW of capacity, will open on April 14th. The site comprises two wind farm sites, each likely to have 60 turbines rated at 14 MW. The winners will be announced after the summer and the projects are expected to be operational by 2025/26. Transmission system operator TenneT will construct two offshore platforms for them.

France aims to put 8.75 GW of offshore wind capacity out to tender by 2028, adding them to nine offshore wind projects already in the pipeline that will give it up to 12.4 GW of offshore wind in operation or under development by the end of 2028. One tender is currently underway for a 270 MW floating offshore wind project off the south of Brittany. There are also four demonstration floating wind projects under development.

Germany has started updating maritime spatial plans to accommodate an additional 3 GW of offshore wind capacity in the North Sea.

Rising wholesale prices benefit renewables, hit consumers

Some renewable energy generators have benefitted from rising power prices across Europe even as consumers face large bill increases.

Fred Carita, Manager of Developer Services, Europe, at LevelTen Energy, said: "With wholesale prices being as high as they are, developers are raising their Power Purchase Agreements (PPA) prices to make up the revenue they could have otherwise made selling a greater percentage of their electricity on the day-ahead market."

Some renewable generators operating in Great Britain have been making payments to energy suppliers. Their projects were funded under the UK's Contract for Difference regime, under which consumers provide 'top up' payments for generators when market prices are below a 'reference price'. When the market price exceeds the reference price, which has been the case this winter, the difference is repaid to suppliers.

For consumers, however, high market prices have forced governments to act to relieve the burden on households and businesses. In Spain, for example, the Council of Ministers extended VAT reductions and cuts in various electricity taxes. Teresa Ribera, Vice-President for Ecological Transition, said: "It is essential to maintain the elimination of these taxes so that this situation does not end up being reflected in the bills paid by consumers." The UK is discussing measures to take effect in April when a price cap on standard tariffs is due for its six-monthly review.

Distribution and transmission networks mark first collaboration

The EU's DSO Entity (the group of distribution system operators) and ENTSO-E (transmission companies) have signed a Memorandum of Understanding (MoU). They want to work together in areas such as developing, implementing and monitoring network codes, and promoting best practices in operating and planning networks to reach net zero carbon emissions.

Vincenzo Ranieri, President of the EU DSO Entity, said: "The ambitions to achieve a climate-neutral European society within 2050 require a strong collaboration between all the main stakeholders of the energy ecosystem, such as TSOs and DSOs.

"The MoU represents a key step in the path of dialogue our associations embraced, to contribute to a flexible, resilient, and open European Power System by defining standards and guidelines and nurturing our common knowledge."

Hervé Laffaye, ENTSO-E President, said: "Close cooperation between transmission and distribution system operators is essential to enable the energy transition. The MoU sets a clear framework to foster an ambitious cooperation at the European level, necessary to support the European climate objectives."

In a first collaboration, the two organisations recently submitted a joint proposal to regulators' group ACER for a Network Code on Cybersecurity. It aims to set a European framework with a clear definition of the roles and responsibilities of the different stakeholders for each activity.

Europe's nuclear generation falls further

■ End of life, policy and technical issues close plants
■ New plants in Eastern Europe years away

Janet Wood

Power supplied from Europe's nuclear plants has dropped as 'end of life' closures in some countries coincide with policy-driven nuclear withdrawals and technical issues. Plans for new plant are small-scale and far from the market in comparison.

Some closures were planned. Germany recently closed three nuclear plants, leaving just three in operation, and it expects to close the last three in a year. "By massively increasing renewable energy and accelerating the expansion of the electricity grid we can show that this is possible in Germany," said Economy and Climate Minister Robert Habeck.

Longer term, more closures are expected. Belgium has been discussing closing its seven nuclear units since 2003 and it recently decided to assess whether closing all of them would endanger Belgium's energy security amid recent debate over gas supply shortages. "It would not be smart not to have a safety net," said Prime Minister Alexander De Croo, indicating that two plants could remain open. A definitive decision is expected in March.

In the UK, nuclear generation has fallen recently to its lowest in four decades after EDF Energy decided to close its two-unit Hunterston B nuclear plant. It had previously been expected to operate through another winter. Paul Forrest, Hunterston B station director, noted: "It was originally thought Hunterston B would run for 25 years but investment in the plant and the people who work here mean we've been able to safely extend that to 46 years. This is an incredible achievement and everyone here is proud of what the station has accomplished."

There were other unexpected nuclear shortfalls. Nuclear provides 70 per cent of France's power from 56 reactors, but it is not producing as much power as usual, because a dozen reactors have been shut down recently for unplanned maintenance. That has reduced output enough to require more power from France's little-used coal fired stations.

On the positive side for nuclear, the Czech Industry and Trade Ministry said it is "a priority" for it to support nuclear energy alongside renewables as it aims to phase out coal. "We will create such conditions for the energy transformation and development of coal regions to make it possible to phase out coal by the year 2033," it said in a new policy document. Hungarian Prime Minister Viktor Orban said he plans to meet with Russia's President Vladimir Putin in February to discuss two new units at the Paks plant, while Poland recently selected a site on the Baltic Sea for its first nuclear plant.

Power companies move toward green and blue hydrogen supply

Finnish energy company Lahti Energia Oy will join Nordic Ren-Gas Oy to build Finland's largest green hydrogen investment – a €250-million project to produce hydrogen and renewable methane using electrolysis.

The two partners have begun a technical and economic feasibility analysis. Construction work could start in 2023 with a 20 MW electrolyser commissioned in 2025, and by the end of the decade the facility could reach 120 MW. The process is planned to run on electricity from 300 MW of new wind farms that will be contracted under long-term power purchase agreements.

Across the North Sea, Equinor recently submitted plans to the UK government for its H2H Saltend plant, a 600 MW plant that will produce hydrogen from natural gas with carbon capture and storage.

The company wants government support for the plant, near Hull in northeast England, which it says will provide hydrogen to fuel neighbouring Triton Energy's power plant and be a feedstock for nearby chemical industries.

Irene Rummelhoff, Executive Vice President for Marketing, Midstream and Processing at Equinor, said the project was "a major step" to a wider hydrogen economy, which can reduce emissions across several sectors, act as a catalyst for greater inward investment and economic growth, and ultimately result in a zero carbon Humber.

Energy transition "central to Africa's economic future, says report

Africa's wealth and welfare will be boosted by policies in support of renewable energy deployment, claims green energy agency. **Nadia Weekes** reports

A comprehensive policy framework leading to an African Green Deal would raise the continent's GDP by 6.4 per cent and create 26 million extra jobs by 2050, according to analysis from the International Renewable Energy Agency (Irena) in collaboration with the African Development Bank (AfDB).

Coordinated policies focusing on the energy transition could bring a wave of new sustainable energy investment to Africa, concludes the 'Renewable Energy Market Analysis: Africa and its Regions' report.

Development enabled by renewable energy deployment is benefiting Africa economically while greatly improving energy access and offering welfare and environmental benefits to people across the continent, it finds.

An energy transition in Africa aligned with global climate ambition shows the continent generating 26 million more economy-wide jobs by 2050 than is anticipated under a business-as-usual scenario.

Jobs created through the energy transition in Africa would outstrip fossil fuel-related job losses by a factor of four, representing a significant net gain to regional economies. Around two million people currently work in the fossil fuel industry in Africa.

"Africa's governments and people are too often asked to rely on unsustainable fossil fuels to power their development when renewable energy and energy efficiency solutions offer economically attractive and socially beneficial alternatives," commented Irena's Director-General, Francesco La Camera.

"The transition offers a unique opportunity for Africa to meet its development imperatives. Through tailored policy packages, African countries can harness their strengths and resources to overcome long-established structural dependencies."

Coal, natural gas and oil together account for about 70 per cent of Africa's total electricity generation today. Conventional power attracts far more funding than renewables owing to an established process that favours less capital-intensive thermal generation, the report notes.

It calls for energy transition finance to become more readily accessible, and for coordinated efforts to ensure that public spending prioritises renewable energy projects.

Of the $2.8 trillion invested in renewables globally between 2000 and 2020, only two per cent went to Africa. While the rate of access to energy in Sub-Saharan Africa rose from 33 per cent to 46 per cent over the last decade, rapid population growth meant 570 million people still lacked electricity access in 2019.

Although Africa has abundant renewable energy sources, strong political commitment, an adequate policy framework and massive investment are required to achieve a successful energy transition, according to the AfDB.

"The African Development Bank is committed to supporting the continent's energy transition by facilitating increased private sector investments through its expanding range of green finance instruments, including the Sustainable Energy Fund for Africa (SEFA)," said Dr. Kevin Kariuki, Vice-President for Power, Energy, Climate & Green Growth at the AfDB.

SEFA approved in early January a $1 million grant to facilitate Botswana's transition to clean energy.

The technical assistance project supports the government of Botswana in closing critical gaps in policy, regulatory and legal frameworks including least-cost planning, reduction of adverse environmental impacts and support for increased private sector participation in renewable energy investment.

The project is expected to lead to implementation of Botswana's first Integrated Resource Plan (IRP), thus facilitating investments in at least 100 MW of new solar PV and 50 MW of new wind generation capacity by 2030.

The project also contributes to the Mega Solar initiative, launched in 2021 in collaboration with Namibia and development partners, which aims to build renewable energy capacity in the two countries and enable electricity exports to the rest of the region.

In a related development, the Eiffel Investment Group (EIG), in partnership with financial advisor Finergreen, is initiating a bridge funding strategy to speed up Africa's electrification and energy transition.

EIG aims to replicate a successful bridge funding programme it already implements in Europe, whereby renewable energy developers are able to start the construction of their projects in parallel with the implementation of a permanent capital structure.

Capital raising from international investors, multilateral organisations, development banks and local partners can be a long and complex process. This is a major contributor to slow deployment of renewable energy on the African continent.

EIG aims to raise a $200 million fund, dedicated to professional investors, to bring together investment from public and private institutions.

The European Investment Bank has already initiated due diligence in view of investing up to $30 million in the fund, and other international public and private investors are said to be assessing the opportunity. Launch is targeted for the first half of 2022.

Game-changing mini-grid inaugurated in Uganda

ENGIE Equatorial has inaugurated a hybrid solar 600 kWp mini-grid, with integrated productive hub and e-mobility, on Lolwe Island in the presence of Uganda's Minister of Energy Ruth Nankabirwa.

The joint project between ENGIE Energy Access and Equatorial Power Ltd. is the most advanced mini-grid on the African continent and is said to represent a game changer for Uganda's energy landscape.

The Lolwe mini-grid connects more than 3000 households and 700 businesses, providing 15 000 people with clean and reliable electricity, as well as a range of other services.

The Lolwe mini-grid features a productive hub that includes water-pumping, distribution and purification services, modern fish-drying facilities and ice-making devices to conserve the daily catch of fish.

The project also offers an electric mobility solution for fishing boats and motorcycles. Additionally, ENGIE Equatorial says it is providing business incubation and asset-financing services to empower the growth of local businesses.

"With the Lolwe project, we demonstrate our vision of energy access: electricity to us is not an end but a means to offer other essential services like clean water, agro-processing, and electric mobility as well," said Riccardo Ridolfi, CEO of ENGIE Equatorial.

"This is the vision we believe will truly impact communities and bring financially and socially sustainable development to the African continent," he added.

"The Lolwe mini-grid is setting the stage for the next generation of decentralised energy infrastructure, and will help to accelerate universal energy access," said Gillian-Alexandre Huart, CEO of ENGIE Energy Access.

The project is scalable to the entire Lake Victoria region and can be rolled out across other African countries, according to the developers, subject to adequate institutional support.

Azerbaijan eyes Caspian Sea's 'huge' offshore wind potential

- MoU with ACWA Power to assess development options
- Steering committee and working group to be set up

The potential of wind energy in the Azerbaijani sector of the Caspian Sea is 20 times higher than the installed capacity of power plants in the country, according to the Deputy Energy Minister of Azerbaijan, Elnur Soltanov.

"By using a small part of this potential Azerbaijan can fully meet its electricity demand with renewable energy sources," he said.

"Our potential is huge. The implementation of these projects depends on economic profitability. The goal is to implement these projects at the lowest possible price, in accordance with the tariffs in force in Azerbaijan," Soltanov added.

He also said that foreign investment in renewable energy "will bring big dividends" to Azerbaijan.

Azerbaijan signed a Memorandum of Understanding (MoU) on January 13th with Saudi Arabia's ACWA Power to collaborate in assessing the potential for developing offshore wind energy.

The document was signed by Soltanov and ACWA Chief Investment Officer Clive Turton during the groundbreaking ceremony of the 240 MW Khizi-Absheron onshore wind power plant, which is due to be commissioned in 2024.

A steering committee and working group will be established to guide and control the activities carried out under the MoU. ACWA Power has plans to build a 500 MW offshore wind farm in the Azerbaijani sector of the Caspian Sea.

In April last year Azerbaijan signed another MoU to collaborate on offshore wind development with the International Finance Corporation (IFC). It wants to develop a roadmap leading to tenders for projects, partnerships with the private sector, and additional investments.

The World Bank estimates that Azerbaijan has the technical potential to develop 157 GW of offshore wind energy, of which 35 GW for fixed-bottom projects and 122 GW for floating wind.

In its Renewables 2021 report released in early January, the International Energy Agency (IEA) forecast cumulative offshore wind capacity to more than triple by 2026, reaching almost 120 GW.

Growth will be driven by continued deployment in leading markets such as China and northern Europe, as well as rapid expansion in new markets including the US, Japan, and South Korea. In Vietnam, the IEA expects to see 11 GW of new wind capacity by 2030, including some large-scale offshore wind projects.

Corporate power and renewables companies must prepare for rising near-term risk

- Greater complexity in project development will bring greater risk
- Investors will push listed utilities to justify integrated business models

Junior Isles

Corporate power and renewables companies need to prepare for rising near-term risk as the rush to decarbonise the global energy system heightens, says a new report by Wood Mackenzie.

According to the 'Corporate power and renewables: 5 things to look for in 2022' report, the complexity of achieving project progress with buy-in from investors may be the biggest barrier to meeting targets being set.

Calls for improved disclosure on emissions performance and environmental impact are increasing as investors seek best-in-class performance on ESG, so companies need to outline plans to decarbonise their entire business, including intermediate targets on the road to net zero.

Activist investors will push listed utilities to justify integrated business models, and Wood Mackenzie also expects the M&A market to heat up as buyers see acquisition as the most expedient way to capture the growth potential of renewables.

In the wind and solar markets continued pressure on capex, impacted by rising equipment costs, will force auction prices up in 2022, noted the company. Polysilicon, steel, copper and aluminium pricing, combined with logistical bottlenecks had forced equipment price increases throughout 2021, and companies will now need to work to protect their margins.

Norman Valentine, Director, Corporate Research at Wood Mackenzie said: "Business leaders will need to address a range of concerns to build credibility on how they will deliver competitive advantage in the fast-changing world of the energy transition.

"Significantly greater complexity in project developments' paths to completion will bring greater risk – where to bid, when to bid and what to bid will be under the microscope, in what is already a complicated process."

According to the report, utilities and energy companies will see demand from corporate clients that want broader decarbonisation packages accelerate in 2022 – with customers, such as industrial and chemicals companies, under growing pressure from stakeholders to confirm their strategies. The number of companies setting emissions targets has risen sharply and many are now aligning with net zero goals. COP27, in late-2022, will focus on raising ambition for 2030 targets. Scrutiny on tangible corporate progress towards emissions targets will heat up rapidly, the report said.

"Companies need to prove they are meeting their lofty ambitions in terms of decarbonisation at all levels of their operations," said Akif Chaudhry, Principal Analyst, Corporate Research at Wood Mackenzie.

Wood Mackenzie also said that the increasing share of renewables in the power generation mix makes intermittency a bigger challenge to the sector and any failures to keep the lights on in 2022 would severely undermine confidence in utilities' role in leading energy transition change.

"Utilities are already in the spotlight, with high-profile, weather-related power outages – combined with spiking prices – and the challenges will only mount as extreme weather events become more common. Expect more announcements on supply contracts from utilities and energy companies involving a combination of low carbon solutions for corporate clients in 2022. This will also be a critical part of utilities and energy companies' efforts to tackle their own Scope 3 emissions," said Chaudhry.

Utilities move to boost sustainability credentials

Europe's largest energy utilities are continuing to make significant progress in sustainable projects aimed at supporting the energy transition.

Last month, German energy giant, E.On, issued a €800 million ($906.8 million) green bond that will be used to finance green projects under the company's Green Bond Framework. The bond, which is due in October 2034 and bears a coupon of 0.875 per cent, will support initiatives in the areas of electricity distribution infrastructure and equipment, renewable energy production and storage, energy efficiency as well as electric vehicle charging stations and supporting electric infrastructure.

The Essen-based company also placed another note of €500 million to fund general corporate purposes. The bond matures in January 2026 and has a coupon of 0.125 per cent.

The two tranches were oversubscribed with the combined order book reaching €4.2 billion.

In November, the energy major unveiled a plan to spend €22 billion through 2026 on the expansion of its electricity grid and invest about €2 billion to advance digitalisation in an investment offensive with a focus on the energy transition.

In line with its transition strategy, in January E.On also announced a new partnership with Horisont Energi of Norway. The companies plan to develop a "European end-to-end carbon capture, transport and storage service offering", a statement said. They also want to produce clean hydrogen and ammonia.

As part of the agreement, E.On is to acquire a 25 per cent stake in Horisont Energi.

Under the deal, E.On will take responsibility for carbon capture and liquefaction, while Horisont will be responsible for transport and sequestration of carbon dioxide.

The two companies also intend to develop a business built around carbon dioxide removal, pointing to the European Commission's "vision for carbon removal". In conjunction with these plans, the two companies are developing business models on clean ammonia production and supply.

E.On's announcements follow Enel's news in late December that the Italian energy major signed a sustainability-linked finance agreement with the European Investment Bank (EIB). The financing will cover energy efficiency measures and the construction of small and medium-sized renewable energy plants.

The projects will be implemented in specific Italian regions, in line with the European Union's Cohesion Policy, thereby contributing to the development of areas of the country with unemployment levels above the European average.

Gelsomina Vigliotti, Vice-President of the European Investment Bank, commented: "The 'Sustainability-Linked' framework financing finalised with the European Investment Bank will allow us to strengthen our commitment to the energy transition, through the development of energy production from renewable sources and energy efficiency, in line with the 'zero emissions' target by 2040 set out in our 2022-2024 Strategic Plan."

Sustainability high on list of corporate challenges

New research undertaken by one of the UK's leading business energy suppliers, Gazprom Energy, finds that the task of improving sustainability is among the three biggest challenges facing large and medium-sized UK organisations.

The pressures of the recent pandemic and events such as Brexit have meant that factors affecting profitability are a key challenge for businesses. However, sustainability challenges are creeping up on the business agenda, highlighting greater ethical business thinking and an emphasis on people and the planet, alongside profit.

The research, recently published in the 'Road to Net-Zero' report, found that 'identifying ways to reduce energy consumption' (75 per cent) and 'working to reduced budgets' (73 per cent) were the top two energy-related challenges organisations are up against. Despite the obvious concern for budgets, 'trying to meet sustainability targets' still managed to make an appearance near the top of the list, chasing closely behind at 69 per cent.

While promising, this still means that almost one third (31 per cent) of businesses do not consider sustainability a key challenge, despite possible effects on commercial performance and a big push by the UK government in recent years for businesses to go net zero. As a result, just 40 per cent of businesses have made a net zero commitment.

Dan Sullivan, Head of UK Sales at Gazprom Energy commented: "It is important that businesses understand that financial and sustainability priorities do not necessarily contradict each other – in fact, just the opposite. Sustainability initiatives can help to deliver profit and create new business opportunities.

"Taking a sustainable approach to energy usage by conducting an energy audit and implementing measures to improve efficiency can reduce energy costs while also helping businesses to achieve their sustainability goals. Whether the reasons are financial or ethical, the result is the same – a more sustainable organisation."

Financial institutions invest in energy transition

Global financial institutions are increasing investments in efforts aimed at tackling climate change.

In January ING became the first financial institution shareholder in EIT InnoEnergy, the innovation engine for sustainable energy across Europe supported by the European Institute of Innovation & Technology (EIT), a body of the European Union.

The Amsterdam-headquartered global financial institution joins other leading companies actively involved in the energy transition as an EIT InnoEnergy shareholder, such as Volkswagen, TotalEnergies, Naturgy, and EDF.

Since 2010, EIT InnoEnergy has invested €560 million in over 380 companies with a combined forecasted turnover of over €16 billion by 2026.

Jacob Ruiter, CEO EIT InnoEnergy Benelux said: "Sustainable innovations that support the energy transition – like green hydrogen or battery technologies – also depend on banks and companies working together and investing in a green future. ING's pioneering commitment to sustainable energy through its investment into EIT InnoEnergy is a pivotal one for us as we move into 2022."

Gido van Graas, Global Head of New Energy Technologies at ING said: "Sustainability, energy innovations and the energy transition are focus areas at ING. Partnering with EIT InnoEnergy is a major opportunity to further support the energy transition through new and clean energies like battery storage, green hydrogen and solar PV."

Another significant development last month saw the private equity and sustainable investing businesses within Goldman Sachs Asset Management make a $250 million (€220 million) preferred equity financing commitment to Canadian long-duration energy storage specialist Hydrostor Inc.

Hydrostor is the developer of a patented Advanced Compressed Air Energy Storage (A-CAES) technology – a scalable, low-impact and cost-effective system that can provide energy storage from five hours up to multi-day storage where it is needed.

The company said in a statement that it plans to use the investment proceeds to support the development and construction of its 1.1 GW/8.7 GWh of A-CAES projects in Australia and California, and to grow its project development pipeline globally.

The investment will be made in tranches tied to project milestones to match Hydrostor's capital needs. It will speed up project execution throughout development, construction and operations alongside Hydrostor's development partners.

Americas

GE to modernise Long Lake hydropower plant

GE Renewable Energy has signed a contract with Avista Utilities to modernise the 88 MW Long Lake hydropower plant on the Spokane River in northwest USA. The contract includes the modernisation of four generating units.

The scope of work includes the complete renewal and supply of the stators, poles, fans, and spider/rim designs. The modernisation work will increase the installed capacity from 88 MW to 100 MW. The first modernised unit is scheduled to enter operation at the end of 2024, while the last will be operational in 2029.

Nordex wins 245 MW of orders in South America

The Nordex Group has received wind turbine orders from South America for 245 MW.

Statkraft placed an order for the supply and installation of 14 N162/5.X turbines for the 80 MW Morro do Cruzeiro wind farm in Brazil. The order also includes a three-year service contract. This is being built in the state of Bahia. Installation of the turbines is scheduled to begin in summer 2023. The turbines will be delivered in an operating mode of 5.7 MW.

The Nordex Group also received an order from Chile to supply 29 N162/5.X turbines for a 165 MW wind project. This includes a two-year service contract with options to extend up to 15 years. Delivery and installation is scheduled for autumn 2022, with commissioning of the first turbines planned for the end of 2022.

Vestas secures 221 MW order in the USA

Vestas has secured an order to supply a 221 MW wind project in the USA. The project consists of 46 V150-4.5 MW turbines, three V110-2.0 MW turbines in 2.2 MW operating mode, and two V136-3.45 MW turbines in 3.6 MW operating mode.

Turbine delivery is due to start in the third quarter of 2022 with commissioning scheduled for the first quarter of 2023.

The order includes supply and commissioning of the turbines, as well as a 10-year Active Output Management 5000 (AOM 5000) service agreement.

Pampa Energia awards De la Bahia II contract

Pampa Energia has signed an agreement with Vestas for the 81 MW De la Bahia II project, close to Bahia Blanca city in the Province of Buenos Aires in Argentina. The order is for 18 V150-4.5 MW wind turbines and a 20-year service contract.

Delivery of the wind turbines is scheduled for Q3 2022, with commissioning scheduled for Q2 2023.

Vestas has a market share of more than 50 per cent of Argentina's 1.5 GW wind turbine fleet in operation.

Nexans to connect South Fork to US mainland

Nexans has received an order to manufacture 110 km of high voltage subsea cables to South Fork Wind, a joint venture between Ørsted and Eversource. The 3-phase 138 kV HVAC subsea export cables will be integrated with two fibre-optic cables and transmit 132 MW to Long Island, New York.

The South Fork Wind Farm is located 35 miles offshore from New York. Construction will start in 2022.

The HVAC cables will be manufactured at Nexans' subsea high voltage plant in Charleston, South Carolina, the only plant in the USA capable of manufacturing high voltage subsea cables.

Asia-Pacific

GE Renewable Energy wind turbines for India

Continuum Trinethra Renewables of India has awarded GE Renewable Energy a contract for delivery, installation, and commissioning of onshore wind turbines. Financial details of the contract have not been released.

GE Renewable Energy will supply 37 units of the 2.7-132 onshore wind turbine, to be set up in the 99.9 MW Rajkot wind farm located in Gujarat, India.

Product design will be carried out at GE's technology centre in Bengaluru, while the blades for the wind turbines will be produced by its plants located in Vadodara. Product assembly will take place at GE's multi-modal manufacturing plant in Pune.

Taiwan chooses Vestas for offshore wind farm

Taiwan Power Company (Taipower) and Foxwell have selected Vestas V174-9.5 MW wind turbines for the 300 MW Taipower Offshore Wind Project Phase II (TPC Changhua Phase II) in Taiwan. Vestas and Foxwell have signed supply and service agreements for the project.

The wind farm, located approximately 14.7 km west of Lukang in Changhua County, is scheduled to come online by September 2025.

The TPC Changhua Phase II was one of the eleven offshore wind projects selected by the Taiwanese government in April 2018 to be developed by 2025.

Mitsubishi leads Japan's offshore wind development

Consortia in which Mitsubishi Corporation is the main stakeholder have been selected to develop all the projects offered in Japan's first fixed-bottom offshore wind auction.

The Mitsubishi-led consortia have been selected to build an 819 MW Yurihonjo wind farm offshore Akita Prefecture, a 478.8 MW Noshiro Mitane Oga project, also off Akita Prefecture, and a 390.6 MW Choshi project off Chiba Prefecture.

All three projects will feature GE Haliade-X wind turbines with an individual capacity of 12.6 MW.

The Yurihonjo offshore wind farm will comprise 65 wind turbines scheduled to be fully commissioned by December 2030. The consortium involved comprises Mitsubishi Corporation Energy Solutions, Venti Japan, C-Tech Corporation, and Mitsubishi Corporation.

The Noshiro Mitane Oga will feature 38 wind turbines due for full commissioning in December 2028. The consortium consists of Mitsubishi Corporation Energy Solutions, C-Tech Corporation, and Mitsubishi Corporation.

GE Haliade-X wind turbines will install 31 at the Choshi wind farm, with full commissioning expected in September 2028. Mitsubishi Corporation Energy Solutions, C-Tech Corporation, and Mitsubishi Corporation are jointly developing this project.

94 MW Philippine solar project for JGC

Aboitiz Power has awarded an EPC (engineering, procurement and construction) contract to JGC Philippines for the 94 MW solar project in Luzon Region, Philippines. The solar facility will be located in Bugallon municipality, Pangasinan province.

Work on the facility is due to be completed by the end of 2022.

Europe

Wärtsilä to supply flexible 110 MW plant to Italy

Wärtsilä will supply a natural gas fired, 110 MW flexible power plant to Cassano d'Adda in Italy. The plant will be used to balance the power system and ensure its stability when the share of renewables is increased. The order was placed by A2A Gencogas, and it will be delivered on a full EPC basis in partnership with Italian engineering group Cefla.

The new plant will operate with six Wärtsilä 50SG gas engines. Delivery of the equipment is scheduled for autumn 2022, and the plant is expected to become operational in 2023. When completed, this will be the largest power plant in Italy operating on gas fuelled internal combustion engines.

Iberdrola to use 5.X wind turbines in Spain

Iberdrola will use 5.X platform wind turbines from Siemens Gamesa for the 94 MW Iglesias wind farm in Burgos in north Spain. This will be the first use of the 5.X wind turbine in Spain.

Siemens Gamesa will supply 14 SG 6.6-170 and two SG 5.0-145 turbines. The first 14 turbines will operate at a nominal capacity of 6.0 MW. The wind farm is scheduled to be commissioned in early 2023. The contract includes a five-year service agreement.

The nacelles for these turbines will be manufactured at Siemens Gamesa' plant in Ágreda. The project will also boost the activity of Siemens Gamesa's Spanish suppliers, which will be involved in the production of various components, such as the wind turbine towers.

Lars Bondo Krogsgaard, Onshore CEO of Siemens Gamesa, said: "This marks a debut for the Siemens Gamesa 5.X platform in Spain. The 5.X is the most powerful turbine in the sector and can provide a real boost to the country's energy transition."

Finnish order of 380 MW for Nordex

The Nordex Group has received an order for the 380 MW Pjelax-Böle-Kristinestad Norr wind farm cluster in Finland. Nordex signed an agreement with Finnish utility Fortum to supply, install, and commission 56 N163 6.X wind turbines. The order also includes a long-term service contract.

The project is located in the municipalities of Närpes and Kristinestad in southwestern Finland. Installation of the turbines, which will be delivered in a project-specific operating mode of 6.8 MW, is scheduled to begin in the spring of 2023.

This is the largest order Nordex has received in Finland.

Vestas wins 56 MW order in France

Vestas has received an order to supply 56 MW of turbines for a wind power project in France. The contract includes the supply and installation of 18 wind turbines of the 4 MW platform, including V136-3.45 MW, V126-3.45 MW and V117-3.45 MW turbines delivered in various power optimised modes. There is also a 10-year Active Output Management 5000 (AOM 5000) service agreement.

Turbine delivery and commissioning are scheduled for the second half of 2022. Vestas has not disclosed the project or the customer.

International

L&T construction wins Saudi transmission project

L&T Construction, a unit of Larsen & Toubro (L&T), has secured two contracts from Saudi Electricity Company (SEC) for the construction of a substation and an overhead transmission line system in Saudi Arabia.

The first contract, valued at $33.4 million, involves construction of a 380/132kV gas insulated substation at Al Uwayqilah 380kV bulk supply point (BSP).

The second contract, valued at $32.6million, involves the construction of a 380 kV overhead transmission line of 80 km length between Buhira BSP and Tabouk BSP.

UAE HVDC contract won by Samsung C&T

A joint venture of Korea Electric Power, Electricité de France and Kyushu Electric Power Japan has awarded a $3 billion contract to a consortium of Jan De Nul Group and Samsung Construction & Trading for the Abu Dhabi National Oil (ADNOC) and the Abu Dhabi National Energy subsea transmission project in Abu Dhabi, UAE.

The scope of work includes installation of 135 km long 400 kV HVDC cables to link Das Island to shore and four 320 kV submarine cables spanning 125 km each to link Al Ghallan island to shore.

The two cable links are part of Abu Dhabi National Oil Company's (ADNOC) larger Subsea Transmission System, called Project Lightning, and Abu Dhabi National Power Company (TAQA), which will connect the major city's onshore power grid to all ADNOC's offshore facilities.

This is the first HVDC subsea cable project of its kind in the Middle East and North Africa region. The project is scheduled for commissioning in 2025.

First hybrid solar-wind farm for Turkmenistan

Turkmenistan has ordered a hybrid 10 MW wind and solar farm, the first in the country, from Turkish company Calik Enerji Sanayi ve Ticaret. The hybrid farm will supply power to inhabited areas around Altyn Asyr Lake.

Carymyrat Purcekow, the Turkmen Deputy Prime Minister, said that the project will boost the sector's capacity, enable the training of specialist workers, and create new jobs.

President Gurbanguly Berdimuhamedow said that the construction of cost-effective renewable energy facilities that do not hurt the environment will directly promote development in the Altyn Asyr Lake area.

GE wins Nigerian transformer contract

The Nigeria branch of MBH Power purchased seven 150/187.5 MVA 330/132/33 kV auto transformers and two 100/125 MVA 132/33 kV power transformers from GE. This is to enable the Transmission Company of Nigeria to help meet Nigeria's growing electricity demand. The power transformers are scheduled to be delivered in October 2022.

Hydrogen

Gulf countries take steps towards green hydrogen

- Green hydrogen set to become cost-competitive with existing fossil fuel-based hydrogen in two years
- BP and Oman sign Strategic Framework Agreement and Renewables Data Collection Agreement

Gary Lakes

The Persian Gulf states of Oman and the UAE have taken steps towards large-scale green hydrogen production through agreements with major energy companies, BP and TotalEnergies, respectively. The agreements come as international energy markets are confronting a significant rise in the price of oil and gas, and as concern mounts over the future of oil and gas supplies as Russia and the West confront each other over Ukraine.

The Gulf states have yet to fully get on board the energy transition wagon with most of the big oil producers committing to hydrocarbon projects that will be in operation in 2050 and beyond, yet they are also committing to the hydrogen game, although the use of hydrocarbons and carbon capture technology is expected to be used in some production schemes.

In the past, before the Covid-19 pandemic brought a new emphasis to renewable energies, it was thought that high energy costs for oil and gas would prompt investment and research in alternative energies.

The reverse of that was low energy costs would stifle investment in alternatives. But since the arrival of Covid, and growing awareness of climate change, it appears that that rationale no longer fits. If global markets should enter a period of high prices for energy, or if oil and gas prices go lower, investment and interest in hydrogen appears destined to escalate either way.

A recent study published by Rethink Energy says "investment continues to be ploughed into clean technology," that will fill the gap between renewable energy and net zero emissions.

According to Rethink, the anticipated economies of scale and the green hydrogen production build-out, plus the falling price of renewables, and a rising cost of carbon, green hydrogen – produced using renewable energy – "is set to become cost-competitive with existing fossil fuel-based hydrogen in just two years".

This optimistic forecast, the think-tank said, "will see a violent shakedown of industries that have plodded on with a business-as-usual approach to decarbonisation, without innovation". The report said those companies making investments in green hydrogen now "will dominate the hydrogen supply for existing ammonia and oil refining sectors by 2035".

The report estimates that demand for hydrogen will reach 771 million tons by 2050.

Both Oman and the UAE are oil producers and rely on oil exports for state revenues, but like many others, they have seen the writing on the wall about the coming energy transition and are moving into solar and hydrogen.

In mid-January, BP announced that it and Oman's Ministry of Energy and Minerals had signed a Strategic Framework Agreement and a Renewables Data Collection Agreement that will support the possible development by 2030 of a multiple gigawatt, world class renewable energy and green hydrogen development in the country.

The agreement calls for BP to gather and evaluate solar and wind data from an 8000 km^2 area of land. The information will then help the government of Oman with approving the future development of renewable energy hubs at suitable locations within the area. The renewable energy resources could also supply the power for the development and production of green hydrogen for use in both domestic and global export markets.

The agreement with BP is seen as fitting with Oman's Vision 2040 programme, which is designed to progress the country's economy, health, administrative institutions and environment Oman is already working in partnership with other firms to build green ammonia and hydrogen plants at the Duqm, Sohar and Salalah free zones.

In the UAE, Masdar, Abu Dhabi's renewable energy company, announced last month that TotalEnergies will join it and other partners in a project to produce green hydrogen as a sustainable aviation fuel (SAF). Total Energies and Siemens Energy will act as co-developers for a demonstrator plant project that will be built in Masdar City in the emirate of Abu Dhabi. Masdar City is an urban development run entirely on renewable energy.

"The demonstrator plant will help to establish the commercial viability of green hydrogen as an essential decarbonised fuel of the future, and will support Abu Dhabi's development as a green hydrogen hub," Mohamed Jameel Al Ramahi, CEO of Masdar said in a statement.

Masdar announced last year that it was working on the project with the involvement of the Abu Dhabi Department of Energy, Etihad Airways, Lufthansa Group, Khalifa University of Science and Technology, Seimens Energy and Marubeni Corporation.

Since January 2021, the partners have completed a range of evaluations on technical suppliers, feasibility studies and conceptual designs, while working with regulators on compliance issues, the statement said. Sometime during 2022, the group plans to move into the front-end engineering and design (FEED) stage.

Gas

Gas market future uncertain as Russia threatens Ukraine

As the gas crisis continues, some argue that without additional Russian imports, the ability to refill depleted storage and to avoid a repeat of last year's crisis will be limited.

Gary Lakes

Russia's threatening stance against Ukraine could result in severe gas supply disruptions for Europe. Should Russian President Vladimir Putin order Russian troops to move across the border into Ukraine, it is hard to say exactly what the ensuing crisis would bring, but it could certainly risk an energy crisis in Europe and perhaps further afield.

Europe already relies on Russia for around 40 per cent of its gas supply, and according to the International Energy Agency (IEA), Moscow has during the last quarter of 2021 reduced this volume by around 25 per cent, leading to an "artificial tightness" in the gas market. This action by Russia has been taken "despite the exceptionally high market prices for natural gas that we have seen in recent months," IEA Executive Director Fatih Birol said in a recent statement.

Complicating this is the fact that Europe's average inventory levels currently stand at around 50 per cent. A shortage of gas would force Europe to turn to coal, just when it has been moving forward with its renewable energy programme to reach net zero by 2050. Finding alternatives for Russian gas could see more LNG arriving from the US and possibly Qatar, which the US is reportedly urging to boost deliveries to Europe. Germany, which receives gas directly from Russia through the Nord Stream I pipeline, could be put on the spot due to the fact that it has shut down its nuclear reactors, depriving itself of that energy source.

The Nord Stream II pipeline, which runs parallel to Nord Stream I with the same capacity of 15 billion cubic metres (bcm), has yet to be completed and its own future is uncertain. The Nord Stream project was envisaged by Moscow as a means to bypass Ukraine, which served as a main route for Russian gas to Europe for decades. War in Ukraine would invariably complicate gas shipments through this traditional route.

Concern over high gas prices and supply has been a global concern since before the issue of Russia massing troops on the Ukrainian border. Over the last few months, gas prices have spiked to record highs, with electricity prices following.

Prior to the current situation where analysts are now questioning whether Russia might actually halt gas supplies to Europe, Wood MacKenzie emphasized Europe's need for an increase in gas supplies.

In a report issued in mid-January – 'Europe Gas: 5 things to look out for in 2022' – the Edinburgh-based consultancy forecast that gas prices would decline in Spring if more Russian gas is available, "but get ready for another unsettling year," it said.

"Without additional Russian imports, the ability to refill depleted storage and to avoid a repeat of last year's crisis will be limited," Wood Mackenzie analyst Kateryna Filippenko said in the report. "But Gazprom has so far been reluctant to make more gas available on the existing routes. And the start-up of Nord Stream II remains the big unknown as Gazprom navigates regulatory approval," she said, adding: "Political relations remain fragile as Russian troops amass along the Ukrainian border."

The consultancy said Europe will need as much as 20-25 bcm to bring its storage system to sufficient levels. According to the paper, a EU strategic storage policy will support progress but will take several years to implement. A new EU strategic storage policy will require an overhaul of regulations which significantly vary from country to country, Graham Freedman, principal analyst said in the paper, adding that a framework would need to be worked out to ensure consistency across the industry.

The paper also noted that long-term contracts will be needed to assure a steady supply of gas. Europe has in recent years moved towards hub pricing and the spot market, but the current crisis has shown that that system can have drawbacks. It also noted that more attention is needed for gas produced within Europe and said high gas prices could see operators move ahead with stalled final investment decisions.

The consultancy said in the report that gas prices would need to come down to accommodate increased investment in gas use, but that the use of unabated natural gas in the EU is set to decline, even if the EU classifies investments in gas fired plants as transitional investments.

Whether the gas market continues on this, or a worse track, is a decision that will likely be made in Moscow.

Optimisation strategies for solar-plus-storage in 2022

As the collocation of energy storage with renewable energy becomes ubiquitous, power producers are looking for creative ways to harness greater efficiency and sell into new energy markets to increase the value of their assets. Wärtsilä's **Jeff Damron** reveals what the hybrid projects of the future will look like, including more efficient coupling designs and the latest revenue-generating application stacks.

According to a new report by Clean Horizon, there are more renewables-plus-storage projects than standalone energy storage systems across the globe. Such projects account for the majority of storage capacity in emerging markets including Africa, Australia and South America. In the US, the largest market for energy storage worldwide, 58 per cent of deployed storage capacity is collocated with solar. In fact, most of the large-scale energy storage systems expected to come online in the US over the next three years will be collocated with solar. Europe is the exception to this trend – 85 per cent of energy storage projects are standalone, due to project economics and restrictions around collocated battery use for ancillary services.

By itself, solar is non-dispatchable, requires ramp-up and ramp-down generation elsewhere on the grid, and needs flexible resources to fill in intermittency and variability of power output. But when paired with solar, energy storage guarantees that reliable renewable power is readily available just like any traditional power plant.

The cost of energy generation from a solar-plus-storage facility has been declining rapidly around the world in recent years. On average, the cost has dropped from over $350/MWh in 2015 to less than $60 per MWh for projects expected to be commissioned beyond 2022. Plus, improvements in PV panel efficiency and availability of larger panels have significantly increased the power and energy density of utility-scale solar plants over the past decade.

According to a study in the 'IEEE Journal of Photovoltaics', median power densities in 2019 were 52 per cent higher for fixed-tilt plants and 43 per cent higher for tracking plants than in 2011. Meanwhile, median energy densities rose 33 per cent for fixed-tilt plants and 25 per cent for tracking plants over this same period. As cost reductions and output improvements continue, solar-plus-storage systems will continue to become more competitive on a levelised cost of energy (LCOE) basis in comparison to conventional resources.

About 99 per cent of all solar-plus-storage facilities globally are AC-coupled, where the battery system and PV plant are connected to separate inverters in parallel. But by reducing the number of AC/DC conversions in a solar-plus-storage system, power producers can reduce inefficiencies and improve revenues.

With DC-coupled solar-plus-storage systems, solar generation flows directly to the battery, via a cost-efficient DC/DC converter, and avoids conversion losses from an inverter. As a result, DC-coupled systems are 3 per cent more efficient than AC-coupled systems. Plus, the DC/DC converter that creates compatibility between the PV panels and the battery is less expensive than purchasing a second inverter needed for AC-coupled systems. This translates to both lower capital expenditure and installation costs.

However, there are some applications where AC-coupling remains the most cost-effective strategy. For example, AC-coupling is more appropriate for large solar plants collocated with small energy storage systems because the energy being stored will be highly impacted by efficiency losses. Additionally, if the same battery is going to be used by other generation sources, DC-coupling would increase efficiency losses due to the impact of power flows at the AC/DC conversion stage. Power producers should also be aware that DC-coupled systems typically do not satisfy contractual obligations in some regions requiring a clear demarcation between the metering of solar panels and the battery.

DC-coupling is especially useful for making energy shifting, one of the most popular use cases of solar-plus-storage projects, more profitable. DC-coupling allows power producers to avoid production curtailment by storing power that would otherwise be "clipped" in the battery. To maximise plant productivity, the amount of PV panels deployed is always higher than the rating of the AC/DC inverters. When maximum power is reached on AC-coupled systems, the surplus of the production energy over the inverter threshold is lost. But with DC-coupled systems, the "clipped" energy can easily be stored in the battery.

By storing solar energy directly in the battery, project owners can generate additional revenue by selling power to the grid at night by discharging the battery. Applications like energy shifting, in which the batteries are charged and discharged frequently, benefit the most from the minimal efficiency losses that DC-coupling provides, compared to a direct consumption application.

The trend toward DC-coupled systems pairs well with a growing preference within the industry for prefabricated modular battery enclosures. Modular energy storage systems are highly optimised for DC-coupled systems since the battery can be connected to the inverters that are distributed across the entire PV field rather inexpensively, compared to standard 40 ft containers.

Demand for modular systems is growing for both DC- and AC-coupled systems, and for good reason – modular battery design can significantly reduce labour and equipment costs. With prefabricated modular systems, batteries are loaded into modules at the manufacturing facility – unlike container-based solutions, where equipment is installed in the field.

Greater system efficiencies translate into greater energy yield. As new energy markets emerge, those yields can become new sources of revenue. However, the future of solar-plus-storage is more than just hardware; software optimisation is a critical next step to ensure utility-scale storage systems coupled with renewables are fully optimised.

Smart energy management systems can support a variety of applications to maximise the value of the energy produced by the power plant. Leveraging weather, use-case, historical system performance and battery data, energy management software can forecast how much power an adjoining plant will produce and take advantage of and balance for price variations, among other insights.

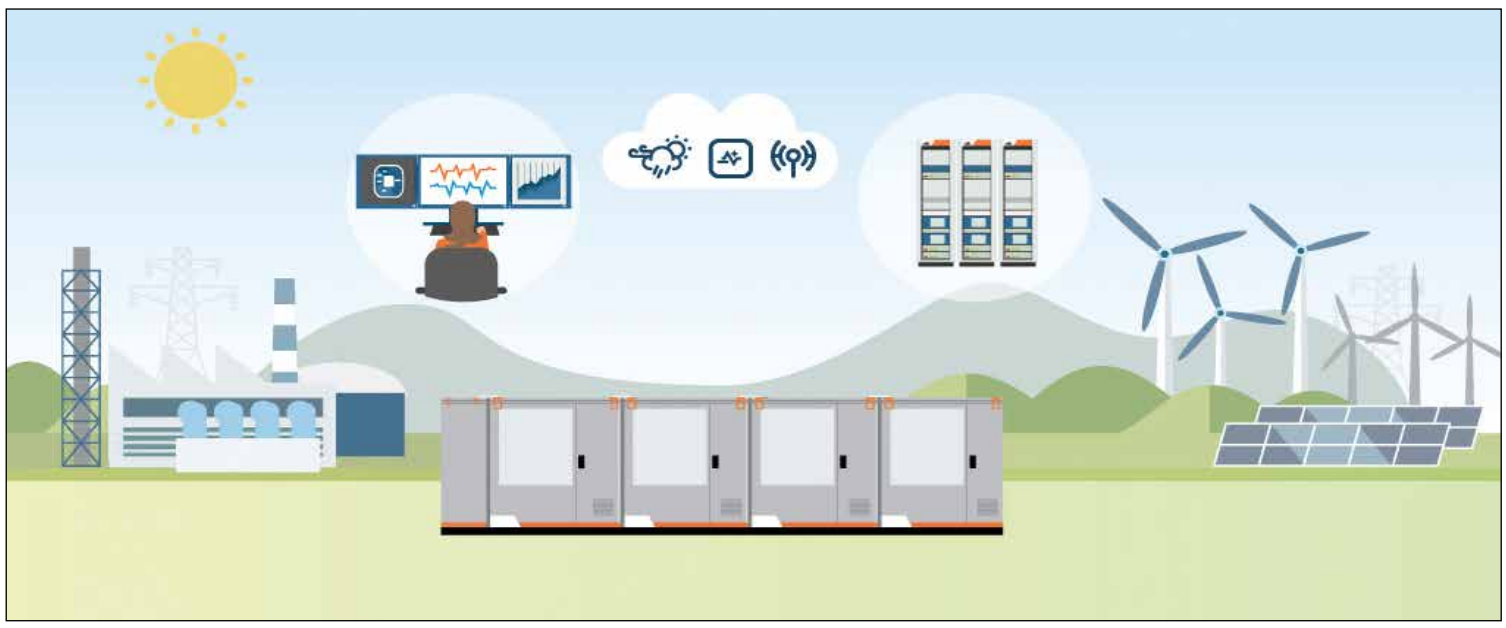
The ability to manage complexity is of the utmost importance when new system designs are implemented. DC-coupled systems are inherently more complex and require additional, although less expensive, components than AC-coupled systems. Software is needed to orchestrate the operation of both the PV inverter and DC/DC converter and ensure compatibility to provide the desired outcome for the plant operator.

Wärtsilä recently commissioned a 40 MW / 80 MWh solar-plus-storage facility in Mitchell County, Georgia, USA, which serves as a great example of this co-optimisation between hardware and software. The DC-coupled design increases energy delivery during peak demand times and enables RWE Renewables to sell nearly 200 MW of solar generation onto the grid.

The facility, however, takes project optimisation a step further. Wärtsilä's GEMS Digital Energy Platform controls the entire hybrid plant while its new cloud-based IntelliBidder software automatically bids firm energy into the day-ahead markets. IntelliBidder leverages machine learning and optimisation algorithms based on automated and forecasted data and real-time trading for elevated value-based asset management and portfolio optimisation.

Due to the increased penetration of clean power and trends in mass electrification, including the anticipated surge in electric vehicles, it is critical for energy and solution providers to continue to innovate to meet demand while ensuring grid reliability and affordable power prices. There is significant opportunity for power producers to save resources by implementing optimisation strategies, and ultimately benefit the bottom line. DC-coupling, modular design, and energy management software are key optimisation strategies we are confident will generate meaningful returns for power producers in the new year and beyond.

Jeff Damron is Senior Director, Global Business Development & Marketing, Energy Storage at Wärtsilä.



Most of the large-scale energy storage systems expected to come online in the US over the next three years will be collocated with solar to provide dispatchable power.
Image courtesy of Wärtsilä

Carving a path in a brave new world

When it comes to new energy business models, there is much to be excited about, but there are also causes for concern. Capgemini's **James Forrest** discusses a new report that examines the opportunities and critical challenges that lie ahead.

Energy and utility (E&U) organisations find themselves at a crossroads on the energy transition journey. Continue down the well-trodden path or take a new route and see what it has to offer. With many discovering success with new practices, the right choice has never been clearer – but can they all make it in time?

The forces of decarbonisation, decentralisation, and digitisation are compelling organisations to act for their own survival as much as for our planet's. As the biggest contributor to climate change with 73 per cent of global emissions, the energy industry must play a leading role in building a cleaner, sustainable future as well as helping customers to reduce their own emissions. To do so, organisations must change tack and adapt to new energy models, quickly. The next decade is crucial in the fight against climate change – organisations must accelerate their transition and grab the opportunities arising now.

Last year marked an inflexion point in the energy transition. The COP26 climate conference provided a global platform for energy firms to demonstrate climate unity and started to galvanise a necessary push to the phasing out of oil, gas, and coal.

We saw established players like Total rebranding to TotalEnergies and set ambitious net zero targets. While BP led the charge for investment in green hydrogen and carbon capture, and transition forerunners, Ørsted (formally DONG Energy), which started divesting its oil and gas business in 2017, became a world leader in renewable energy. Increasingly, accusations of greenwashing fall short of the truth; E&U organisations have recognised the benefits of transitioning to new ways of working and frontrunners are demonstrating just how significant the return on investment can be.

So, what's stopping leaders from following suit and what's likely to happen to those that don't? In our new report – 'Remodelling the Future: how energy transition is driving new models in energy and utilities' – Capgemini found that 71 per cent of E&U industry executives believe that those who do not implement new models will be wiped out, and yet only 22 per cent have actually implemented them. Although a majority (73 per cent) expects new models to be mainstream in their business within the next five years, it's hard to ignore the stark disparity between opinion and action.

It begs the question: what obstacles lie in the way of acting now? Before we answer this, let's look at what we mean by new energy business models.

New energy models are multiple and multifaceted, but all come under the umbrella of business models that deliver greater energy efficiency and a positive environmental impact. Some models are tried and tested like wind and solar. While others like carbon capture storage and hydrogen still require significant investment and development. Whether fully developed or not, diverse models are worthy of investment, and are likely to pay off.

In August last year, for example, Repsol completed its first batch of bio-aviation fuel (known as "biojet") produced entirely from waste. Generating 5300 tons of fuel and cutting CO_2 emissions by 300 tons. It has since become a key feature of Repsol's ESG planning, with 1.3 million tons of sustainable biofuels planned for 2025 and more than 2 million tons by 2030.

The point is that the first step to embracing new models starts by testing them. And with alternate fuels and energy-storage in particular, there are fewer barriers to implementation as they have the best regulatory environments (83 per cent and 80 per cent, respectively) to support application amongst all the models. It is therefore unsatisfactory to see that just 37 per cent of global organisations are currently implementing alternate fuels and only 19 per cent have energy storage solutions. While this may reflect the infancy of certain technologies, there is a sense that not enough innovation and experimentation is happening.

Often with major transitions it may take many years, if not decades, for their benefits to be realised. But it's remarkable to see just how fast companies adopting new energy models are reaping rewards.

Firstly, the hard-nosed business case for transition is strong. Frontrunner organisations are already reporting revenue increases of 6 per cent, with a further 11 per cent expected over the next three years. To illustrate how this pace of profit is possible, just look at power facilities: some fossil fuel plants can take nearly 10 years to construct and are at the mercy of variable fuel prices; on the other hand, renewable facilities can start generating revenues within three years. Spanish utility, Iberdrola, for instance boosted its net profit by 270 per cent in 2021 following its drive to renewables. Ørsted also, which plans to be carbon neutral by 2025, expects growth to continue at a rate of 12 per cent until at least 2027.

Beyond profitability, a shift to cleaner energy models is attracting consumers who increasingly expect green credentials from their service providers. Organisations implementing new energy models have seen a 3.7 per cent increase in new customers and a 4 per cent rise in upselling opportunities. The rapid growth of clean energy suppliers, such as Octopus Energy Group founded as recently as 2015 in the UK, reflects the rise of the eco-conscious consumer and organisations will benefit from engaging with them.

It's more important than ever for leaders to look beyond balance sheets at the wider social benefits and climate impact. Implementing new models is a prerequisite to reducing the sector's significant carbon footprint and we found that organisations with new models are already shedding 4.6 per cent in scope-3 emissions. In the next three years, we expect this to increase to a further reduction of 13 per cent. Major players like E.On SE, are launching ambitious targets based on what they've already managed to achieve. With a 10 per cent reduction in emissions between 2020 and 2019, the German-based company, plans to reduce scope-3 emissions by 50 per cent in 2030 and 100 per cent by 2050.

Despite strong innovation, the fact remains that most are finding it difficult to overcome the status quo and connect intention with implementation. The transition to new models is no small feat and our research found that very few organisations find implementing new models easy, with mobility services ranked as the most challenging.

Part of the problem is that only 18 per cent of organisations say they have a comprehensive, global business strategy for new energy models with well-defined goals. While 34 per cent are still working on developing an overarching new-energy strategy, more troubling is that more than one in five (22 per cent) have no strategy or plans to implement one at all. No strategy does not necessarily mean no progress, but it does mean that new energy initiatives become siloed and difficult to scale. This will hamper the rate of progress that must be made.

Of course, much of this boils down to capability. As many as 70 per cent of organisations say they lack the capabilities to develop new energy models and much of this lies in employee skillsets. Technology specialists, especially those with knowledge of the newest technologies, are not always easily found. More than two thirds (68 per cent) say they lack in-house expertise and just under (62 per cent) say they do not have the adequate skillsets to develop, sell, or manage services. Typically, firms have the domain skills for new models but lack the essential digital capabilities to implement them. This is a global problem, which may take some time to resolve, and so leaders must prioritise training employees.

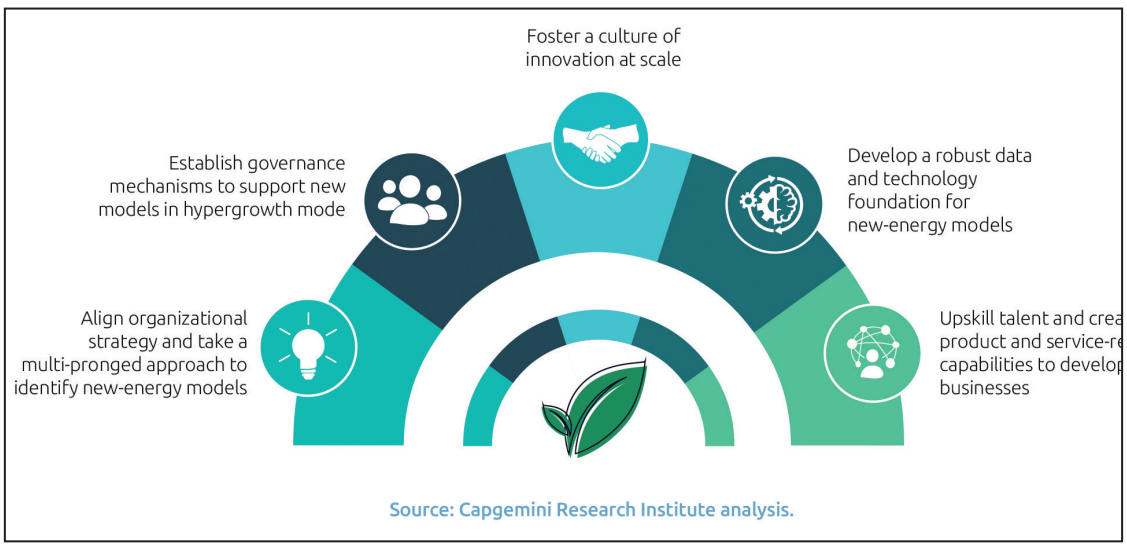
Ultimately, every organisation will have its own unique journey. There is no one size fits all approach, but it remains imperative for leaders to take the right path and start adapting. Only 32 per cent of organisations say they feel under threat from innovative digital disruptors, but it's a mistake to take comfort from a highly regulated environment, which can and is likely to, deregulate.

When it comes to new energy business models, there is much to be excited about, but there are also causes for concern. Successful E&U organisations of the future are those that embrace change, rather than resist it. To accelerate implementation, they must take a multi-pronged approach. Like Repsol's biojet testing, piloting new models in different areas can open doors to new markets and scalable, sustainable opportunities.

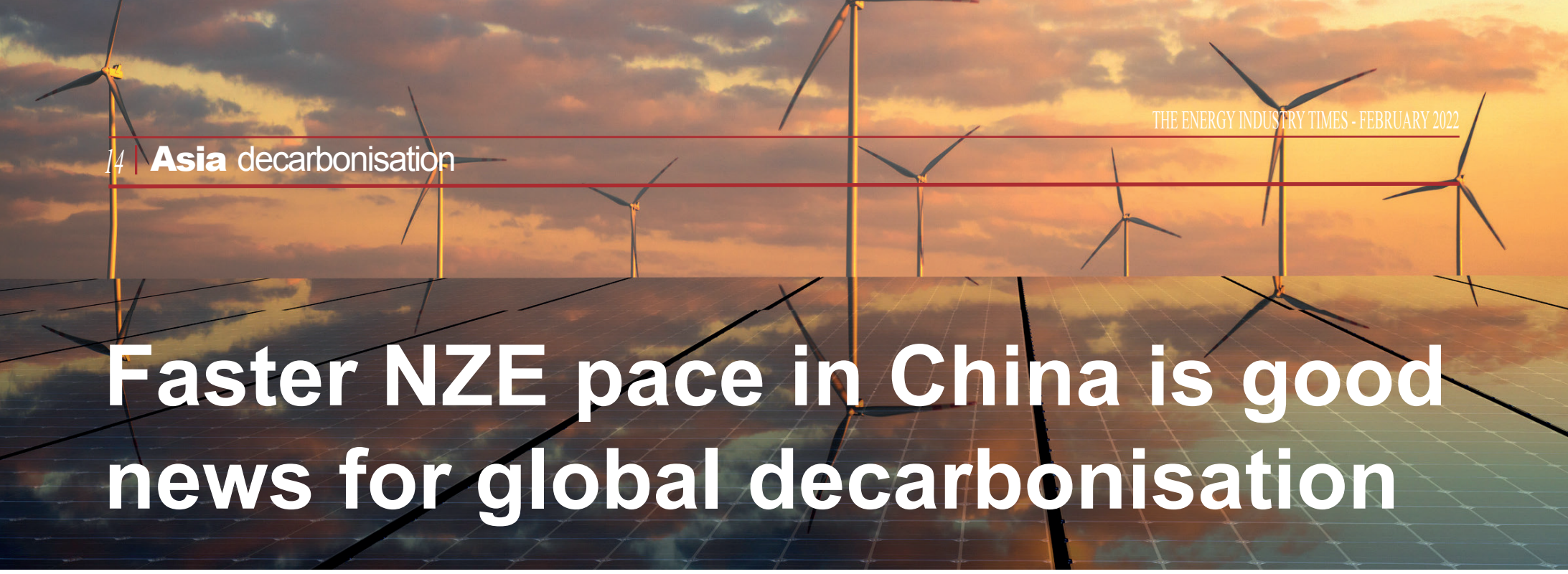
Greater innovation, supportive governance mechanisms, robust data, and effective strategy, are all vital organs of E&U's new outfit, but the beating heart of progress needs to be a sense of urgency. To narrow the gap between intention and implementation, every organisation must feel it. Those who don't will quickly find the well-trodden track ends not long after the crossroads.

James Forrest is Energy and Utilities Lead at Capgemini

Actions for accelerating and implementation of new-energy models



Source: Capgemini Research Institute analysis.



Faster NZE pace in China is good news for global decarbonisation

China plans to install hundreds of megawatts of wind and solar this decade. **Joseph Jacobelli** outlines the key initiatives and policies behind the country's herculean task.

The world's largest electricity user (over 8100 TWh in 2021) and biggest polluter (11 680 million tons of CO_2 in 2020) announced in recent months a variety of measures to accelerate its energy transition to carbon neutrality before 2060. This is a positive development for global net zero emissions (NZE) ambitions and for the development of clean energy projects in the Asia region and the rest of the world from an equipment cost perspective.

Let us first understand the current state of the nation's energy mix before digging into some of the herculean efforts it is initiating on the clean energy side of the decarbonisation path at the national and at the corporate levels.

Electricity consumption in 2021 was as abnormal in China as it was in the rest of the world due to the economic repercussions of the Covid-19 pandemic. Variable renewable energy (VRE) generation – mainly wind and solar – enjoyed double-digit growth, but low hydropower generation resulted in a relatively unchanged ratio of thermal versus clean energy compared to 2022.

In 2021, thermal power (mostly coal generation) was 71.1 per cent of the total, similar to the 71 per cent in 2019. The positive trend is that the contribution from VRE rose by 74 basis points to 9.3 per cent (about 750.4 TWh) of the total generation mix. A small improvement but an improvement, nevertheless. Another positive trend is the absolute VRE capacity increase. China's grid connected wind capacity reached 300 GW in November 2021 while solar reached 306 GW at the end of 2021. A continuation of the massive ramp up of recent years.

Turning to recently announced efforts that the country is making to decarbonise its energy sector, four examples, among the many, that can be highlighted are: an important clean energy policy announcement; aggressive capacity addition targets for the 14th Five Year Plan (2021-2025); green energy consumption stimuli; and on the financial side, the development of the carbon trading market.

In December, at the annual Central Economic Work Conference, China's ultimate leader President Xi Jinping reiterated – we could say reconfirmed – the goal that carbon is to peak before 2030 and that carbon neutrality should be reached by 2060. He said that "realising carbon peak and carbon neutralisation is the internal requirement of promoting high-quality development. We should unswervingly promote it…" [direct translation from Chinese]. This is an important endorsement which puts beyond doubt the commitment that Chinese officials will have to undertake. One of the many manifestations of this is the central bank facilitating cheap funding to banks to subsidise lending to clean energy and green projects.

The current Five-Year Plan, through 2025, is quite important for the energy sector. The country's coal fired generation will peak both in terms of installed capacity and output. Of note, new coal power plants are being built right now but old ones are being retired and coal plants' utilisation rates are being scaled back whenever possible. During the five-year period, wind should exceed 540 GW and solar capacity exceed 570 GW. Energy officials have also earmarked energy storage as a key technology, which needs to be massively ramped up. Other senior officials also volunteered a list of new technologies which are being aggressively pursued. These include deep-sea offshore wind power, new high-efficiency PV cells, and geothermal energy.

Another initiative relates to the consumption of green energy. In early January, seven key government agencies, including the National Development and Reform Commission – the nation's economic planning agency, jointly issued a plan aimed at stimulating the consumption of clean energy throughout the economy.

Three of the many push factors in the plan must be underlined. One is encouraging higher clean energy consumption by industry-leading enterprises, large state-owned enterprises, and multinational corporations. Another is encouraging energy intensive industries to set a minimum proportion of green power in their consumption. A third is to increase green power and green certificates trading, while also educating consumers on signing green power trading contracts, especially medium and long-term trading contracts.

Authorities are serious about green finance, and carbon trading is one of the key facets. The national carbon market officially took off in July 2021 after years, if not decades, in the planning. Most experts, including this author, believe that putting a price on carbon is imperative for energy-intensive industries, which remain the nation's main energy users. The industrial sector consumed 66.3 per cent of the nation's electricity in 2021, about 5509 TWh.

In its first annual report, the Shanghai Environment and Energy Exchange reported that between 16 July, when it was first launched, and 31 December 2021, the total turnover of the national carbon emissions allowance (CEA) market was 178.8 million tons, with a total turnover of Yuan7.66 billion ($1.28 billion) or an average price of Yuan42.85 ($6.76) and a high and low price during the period of Yuan62.29 and Yuan38.50. In 2022, this infant market will see continued expansion as well as capacity building. The trading scheme will be expanded to more industries while the trading infrastructure is enlarged.

The national and local governments are not the only entities that are taking aggressive steps on the NZE path. Corporates are increasingly taking to task as well. To illustrate this, the strategies of two medium-sized listed companies can be profiled.

China Power is an independent power producer with a market value of about $6.3 billion. Last October, it announced an aggressive NZE strategy. Clean energy accounted for about 60 per cent of its total capacity at the end of 2021. It plans to raise this to 70 per cent by the end of 2023, to 90 per cent by the end of 2025, and to over 95 per cent by 2030. Given that the company was born as a coal fired producer, its strategy is no small endeavour.

Tian Lun Gas is a domestic gas distribution company with a market value of about $1.2 billion. Last November, it announced a relatively radical new short-term (2022-2024) business strategy. Firstly, it formed a collaborative alliance with one of China's largest power generation groups – which is likely to be a first – targeting resources sharing and the joint development of smart energy services. Its goal is for its new low carbon energy business to account for 10 per cent of its revenues by 2024.

China will install hundreds of megawatts of VRE capacity in the 2020s. The massive capacity expansion will translate into significant cost reduction per megawatt-hour of the equipment manufactured. For example, various local media have reported that by 2025, the onshore wind generation cost per megawatt-hour will be Yuan100-300/MWh ($15.77-47.33/MWh) depending on the location's wind speed. Also, offshore wind should reach grid-parity (i.e., the average power generation cost in a particular grid), namely a price of Yuan400-500 ($63.10-78.88)/MWh.

The International Energy Agency expects that by 2050 the Levelised Cost of Energy of solar PV, onshore and offshore power output in China will fall to $20-30, and $40/MWh, respectively, from $50, $45, and $115 in 2020. The manufacturing of a massive amount of a variety of energy storage systems will also sharply cut cost in the coming years. The cost gains is a positive factor for the development of clean energy projects in the Asia region as well as the rest of the world from a cost of equipment perspective. This is especially important as the project costs have risen in 2021 given the Covid-led global supply disruptions, which in one or two years from now will prove to have been temporary.

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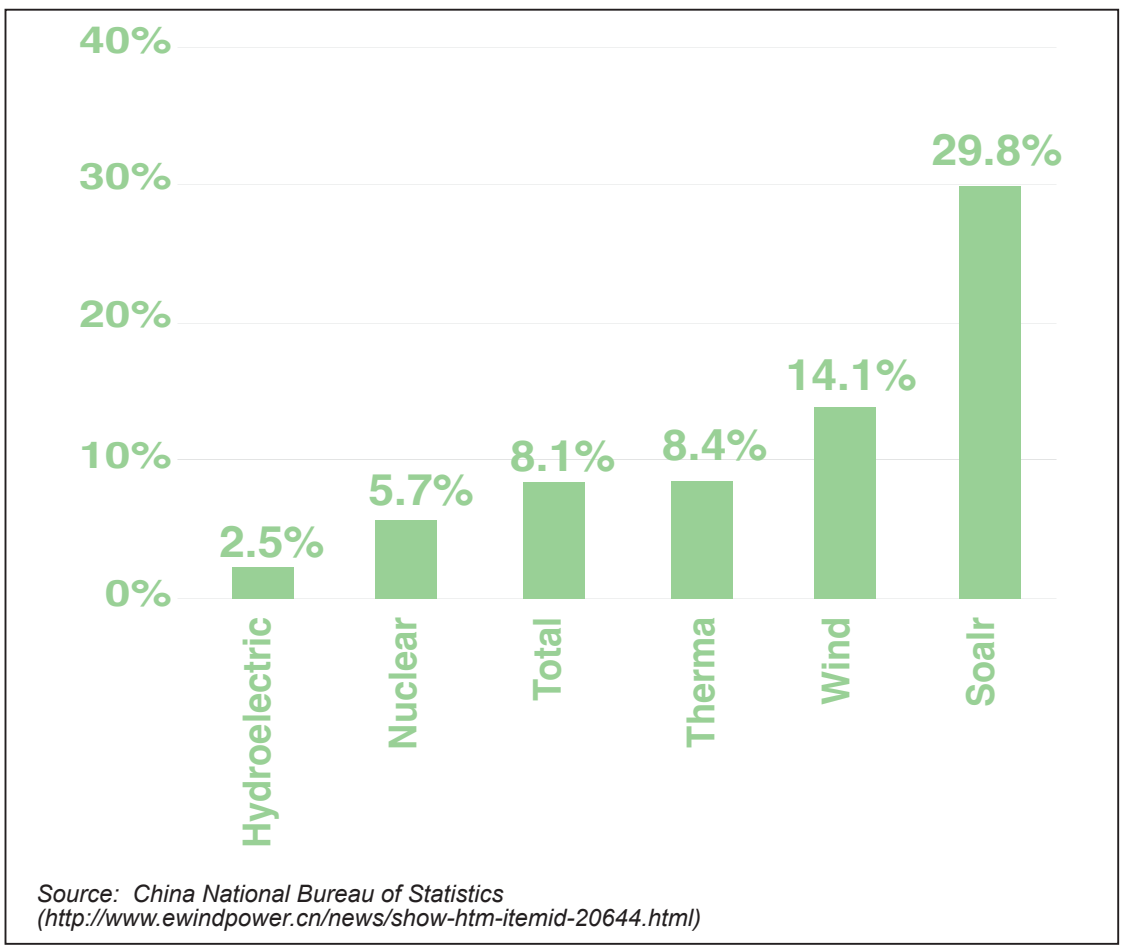
China 2021 power generation year-on-year change by fuel type



Source: China National Bureau of Statistics (http://www.ewindpower.cn/news/show-htm-itemid-20644.html)

Delivering quality power in the renewables era

As more homes turn to renewable energy sources, like solar panels, remote monitoring and managing low- and medium-voltages on the grid becomes increasingly challenging for network managers. ***TEI Times*** hears how Ovarro's remote telemetry system helped manage grid productivity, energy-efficiency and security with higher levels of quality of service in the Netherlands.

While God created the Earth, the Dutch created the Netherlands, goes the old saying – referring to how the country's first settlers from around 400 BCE built the country from earth mounds and dikes to hold back the waters of the North Sea. Now, the country is building a smart grid infrastructure to move away from traditional energy sources to renewables. To overcome the challenges of monitoring these medium-voltage renewable energy sources, smart grid operator Juva turned to Ovarro, a specialist in remote telemetry solutions.

Transitioning to a low-carbon energy system is now the primary focus of Dutch energy policy, according to the International Energy Agency. The Netherlands' 2019 Climate Act has set legally-binding targets to reduce greenhouse gas (GHG) emissions by 2050. First, to reduce emissions to 95 per cent compared with 1990s levels and, second, for 100 per cent of electricity to come from renewables by that year.

As reported by *Reuters*, the country also faces pressure to bring its end date forward to 2030 following COP26. Wind, wave, marine, hydro, biomass and solar are all proving themselves as viable alternative energy sources – but finding the right control technology to monitor these sources effectively presents a challenge for smart grid operators.

Effectively managing assets on a smart grid is only achievable through the capture, storage and interpretation of vast amounts of data from physical assets. However, renewable energy sources like solar rely on low- or medium-voltages, and monitoring these can be more challenging. Renewable sources are unpredictable. For instance, because the sun shines at certain times, solar panels feed energy back into to the grid periodically which can lead to potential instabilities and disruptions in the grid. What's more, conventional remote monitoring systems – aside from being expensive – can be ill-suited to the task of properly interpreting the fluctuating performance data.

These were the challenges faced by Juva, an energy network management company that works together with the grid operator Westland Infra on distribution automation. Together, they manage a smart grid covering an area of 25 to 30 km^2 in Westland, the Netherlands, which involves monitoring around 250 substations in the region. Juva sought a better solution for remote monitoring and managing low- and medium-voltages on the grid.

This need was getting bigger as more and more Dutch homes turned to renewable energy sources, like solar panels. Whereas photovoltaic systems accounted for just 0.05 per cent, or 56 GWh, of the Netherlands' total energy consumption ten years ago, this figure had risen to 6.79 per cent or 8144 GWh by 2020.

Roel van de Konijnenburg, operations technology specialist at Juva, explained: "We needed a flexible, customisable solution to handle the requirements typical of low- or medium-voltage networks. We found that monitoring and control technology platforms from other suppliers tend to focus on a standard template."

Juva was facing limitations with its existing systems. Changes to drives and operating systems were time-consuming and could be difficult to implement. Instead, Juva wanted a solution that would go beyond the normal boundaries – one that was secure, cost-effective and could handle the unpredictable behaviours of renewable energy sources. Fortunately, it had a partner in mind.

"We turned to Ovarro because they are really flexible with implementation," said Konijnenburg. "It's easier to work with them, as a result."

Ovarro has worked with Juva for many years. Ronald Robbertsen, a project engineer at Ovarro who specialises in configuring and implementing medium-voltage network telemetry solutions for grid operators, explained: "We have worked together on all kinds of projects including for the monitoring and controlling of protection relays, energy meters and remote switching of medium-voltage fields."

To investigate how to implement a consistent medium-voltage energy supply across the smart grid, Juva and Ovarro examined some of the key issues. That included issues relative to the three-phase grid, which is the world's most common and economical way of alternating current power generation, transmission and distribution across a network.

Robbertsen said: "The customer saw that the low-voltage solar panels of various households in a neighbourhood were not equally distributed over the three-phase grid. In another instance, a wire in the cable was overloaded due to the high level of sunlight. Juva needed a solution with flexibility to detect these unique instances, and its existing hardware also made it difficult to detect instances of illegal energy use."

Ovarro had to offer a solution that would help Juva manage its grid productivity, energy-efficiency and security with higher levels of quality of service (QoS). To achieve this, it paired-up with Eneida, which specialises in specially designed smart sensor networks, data analytics and unique collaborative software to better analyse and control data on grids.

Ovarro devised a solution with Rogowski coils. Rogowski coils are commonly used to accurately monitor medium- and low-voltages in precision welding systems, arc melting furnaces, in short-circuit testing of electric generators and as sensors in protection systems of electrical plants.

"With this solution," explained Robbertsen, "the installation time is reduced to less than 30 minutes to measure eight fields. Moreover the purchase price is much cheaper than those conventional solutions."

Aside from the Rogowski coils, RTU (remote terminal unit) systems were needed for the capture, storage and interpretation of vast amounts of data from physical assets in the network. RTUs are now a critical part of most power generation and distribution operations, and are essential for today and tomorrow's smart grids. For Juva, Ovarro recommended the Datawatt Smart Grid (DSG) series, which is designed for operation in the water, energy and industrial markets.

The design operates under two main principles: flexibility and maximum security.

Flexible characteristics of the DSG include its ability to implement a variety of protocols in real-time including IEC104, COAP and Modbus, with other protocols available on request. New protocols can be created easily through the Linux operating platform and C# programming language, while programmable logic controller (PLC) programmes can also be made with the latest standard from Codesys based on IEC61131-3 – this standard is the industrial protocol for control programmes and is used by many national and international organisations and companies.

The DSG system greatly benefits the overall security of the network, added Konijnenburg: "The hardware and software of DSG is a definite improvement. You can connect multiple networks in a station – one port is used for communications upwards and another for substation communications. We use a lot of firewall functions to protect these many inputs/outputs (I/Os). The security options aren't limitless, but there are many."

Meanwhile, Juva and Ovarro are also working on two pilot projects together. The first examines the Eneida system connected to the DSG, through which it is possible to monitor energy values in the area, such as from solar panels. This first pilot, went live in Q3 2021 and the plan is to extend it to other locations and companies. It is expected that projects could be physically installed in less than half a day.

For the second project, Ovarro is building Juva a steel cabinet with electrical components that can be placed outside to withstand temperature and weather changes.

"The cabinet has remote maintenance features that provide support when we don't have many people in the field," explained Konijnenburg. "So our engineers don't have to drive out to a station every time there's a fault. Instead, the problem can be monitored and managed through telemetry software in real-time from computer screen in the office. By always communicating data back to the DSG system, the cabinet can be the brains of any station in the smart grid."

These technologies will prove vital as more homes and businesses in the Netherlands turn to low- and medium-voltage renewable energy sources, and as Juva expands its smart grid and the number of substations beyond the 250 it monitors currently. Just as the Dutch created the Netherlands all those years ago, the country is now on its way to creating a fully-sustainable energy grid by 2050 – if not sooner.

Finding the right control technology for renewable energy sources is a challenge for smart grid operators

Junior Isles

From Russia with love

After nearly 60 years, the curtain finally came down on James Bond. Still, films like 'Casino Royale' and 'From Russia with Love' will live on, much like the geopolitical shenanigans that often seem to shroud European-Russian energy relations.

In what must be his most emphatic comments on gas prices and Europe's energy crisis, Fatih Birol, Executive Director of the International Energy Agency (IEA) last month laid blame for Europe's ongoing energy crisis firmly at the Kremlin's doorstep.

Birol said the IEA believed Russia was holding back at least one-third of the gas it could send to Europe, while depleting Russian-controlled storage facilities on the continent to bolster the impression of tight supplies.

Birol said the historic low gas storage levels across Europe were largely due to Russia's state-owned gas company, Gazprom, which has sent about 25 per cent less gas year-on-year in the last three months of 2021, despite a surge in demand after 2020's economic slump. It also calculated that supplies were 22 per cent below pre-pandemic levels.

"The current storage deficit in the European Union is largely due to Gazprom," said Birol, pointing out that storage is at about 50 per cent of capacity compared with 70 per cent normally in January. "The low levels of storage in the company's EU-based facilities account for half of the EU storage deficit although Gazprom facilities only constitute 10 per cent of the EU's total storage capacity."

Analysts estimate that Europe's gas prices could fall by half if Russia agreed to increase its exports by 20 per cent.

Birol said: "We believe there are strong elements of tightness in the European gas market due to Russia's behaviour. I would note that today's low Russian gas flows to Europe coincide with heightened geopolitical tensions over Ukraine."

The criticism renews a bitter war of words between Russia, the EU and US over whether Russia is abusing its role as Europe's main gas supplier to secure approval for the start up of the Nord Stream 2 pipeline to Germany, which has been built as an alternative to transit routes through Ukraine.

The Kremlin and Gazprom, Russia's monopoly gas exporter, deny any wrongdoing, and accused the IEA of trying to "politicise the issue".

Government spokesperson Dmitry Peskov, told the *Financial Times*: "There's no trace of Ukraine in this. Russia is strictly fulfilling its obligations. Russia is ready to supply as much gas as people are willing to buy, but no more."

Gazprom claims it is meeting all its contracted exports to European companies and argue that Europe should have struck multi-year contracts if it wanted to secure stable energy supplies, rather than relying on short-term market prices.

The current situation may not have the cinematic drama and intrigue of 'Casino Royale' but the stakes are high – especially for Ukrainians living under the shadow of an estimated 100 000 Russian troops amassed at the border.

For Europe, the fall-out of the gas shortage has been record-high energy prices, heaping pressure on energy companies and misery on millions of households across the region. And it is a situation that looks likely to get worse before it gets better. In December, prices reached a new record, surpassing the all-time highs reached in September.

Chris O'Shea, head of British Gas, the UK's largest home energy supplier, believes prices are likely to remain high for at least another two years, based on the current outlook for global energy markets.

"There's no reason to think that energy prices will come down any time soon – the market suggests that high prices will be here for the next 18 months to two years," he told the *BBC*.

It is entirely possible that the already astronomical prices could go even higher and be here for even longer, as any estimates will not include the economic impacts of a Russian invasion of Ukraine. There are fears that an invasion would be accompanied by cuts in the amounts of gas Russia supplies to European countries – a tactic to deter sanctions.

OGUK said: "An invasion would be disastrous for the people of Ukraine, but the economic impacts could go much further, directly hitting countries like Germany, which gets 40 per cent of its gas from Russia. It could also indirectly affect many more, including the UK, by triggering price surges."

But rather than point to the need to accelerate the move away from gas, OGUK argues that for some countries it highlights the need for other gas sources. "For the UK it shows the country needs new offshore gas fields to protect its energy supplies," it said.

Whether this should be the direction of travel, however, is questionable – especially when countries are faced with the ultimately more serious issue of tackling climate change.

For Germany – which is phasing out nuclear power by the end of 2022 and plans to exit coal by 2030 – the gas situation is of graver concern than it is for most of its European neighbours, and the country's response may well be an indicator of how things might pan-out for the rest of the continent.

Michael Pahle, of the Potsdam Institute for Climate Impact Research, said the current shocks should speed up state preparations for extended volatility and high prices, which would continue during the shift to renewables.

He expects the government to plan more measures for cushioning low-income citizens, while backing research projects and businesses working on reducing consumption levels.

"As always with a crisis," he said, "you hope something good will come out of it."

Indeed the unfolding events in Russia, Ukraine and Europe must surely highlight the world's need to uncouple energy, or at least electricity, from geopolitics. The transition to a clean energy system offers this hope.

In its annual electricity report, the IEA said 2021 saw the steepest ever increase in electricity demand last year, which triggered blackouts in major economies and led to historic energy price highs and record levels of emissions.

It said this could continue for another three years, with serious consequences for consumers and economies unless there is a faster structural change to the way electricity is produced.

"Policymakers should be taking action now to soften the impacts on the most vulnerable and to address the underlying causes," Birol said. "Higher investment in low-carbon energy technologies including renewables, energy efficiency and nuclear power – alongside an expansion of robust and smart electricity grids – can help us get out of today's difficulties."

But change is sometimes painful and often too slow for those who need it most. In a recent report 'No pain, no gain: the economic consequences of accelerating the energy transition', Wood Mackenzie's said the transition to clean energy, needed to keep temperatures from rising rapidly, may reduce global GDP by 2 per cent by 2050 but may be recoverable before the end of the century.

It also says that while investments in technologies such as solar and wind farms and advanced batteries will generate jobs, the transition is also expected to cause job losses and tax revenues in fossil fuel production.

However, Peter Martin, Chief Economist at WoodMac, stressed: "This is by no means a way of saying we shouldn't pursue the transition or delay it. That pain in the short-term will be rewarded in the long-term."

No doubt many European countries would like to ease the immediate pain by seeing more gas come from Russia with love. But in the end all things will, and must, change.

Although 007 will return, the James Bond saga has closed. Similarly, with the changing energy landscape, Russia's influence on Europe's energy sector will ultimately meet a similar fate to our favourite secret agent. The only uncertainty is when.

Cartoon: jemsoar.com