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Special Technology Supplement

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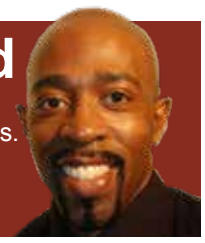

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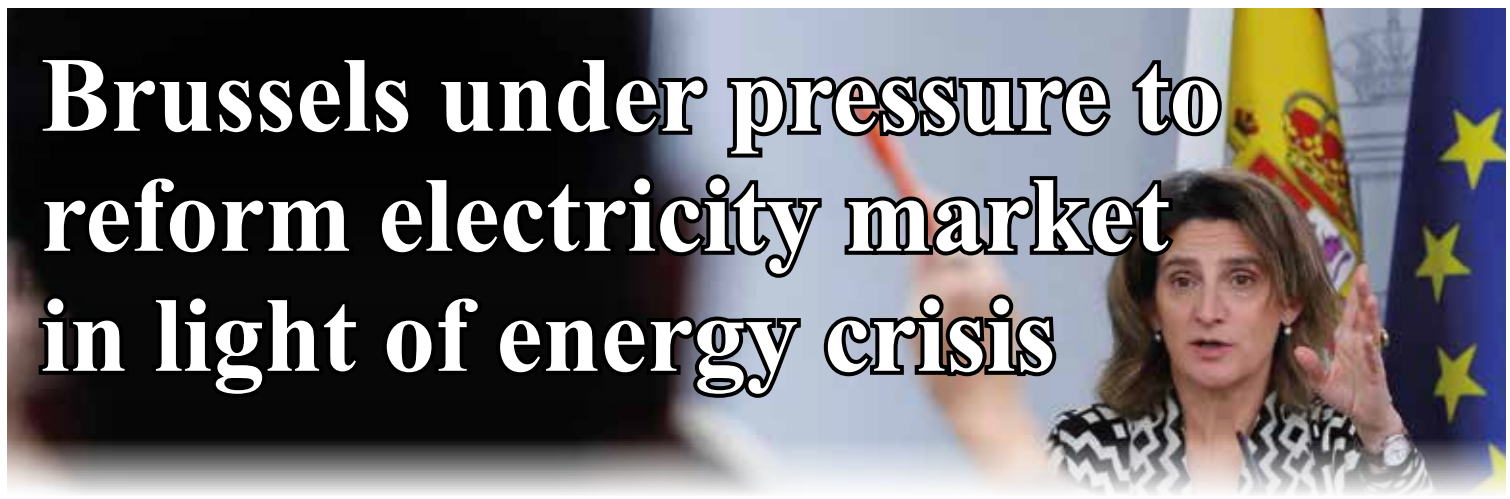
Brussels under pressure to reform electricity market in light of energy crisis



The European Commission is under pressure to revise the electricity market to combat high retail electricity prices, driven by surging gas prices as war escalates in Ukraine. Meanwhile several countries are looking to nuclear as a longer term strategy to pivot away from dependence on Russian gas. **Junior Isles**

Several countries are demanding that the EU modifies the electricity pricing system and make it less dependent on gas prices.

France, Spain, Italy, Greece and Romania have proposed that EU energy market regulation be adapted to protect consumers and reflect the advantages of the energy transition.

France and Spain argue that the final price of electricity for consumers must truly reflect the costs of generation in that country, but without affecting the price formation mechanism of the wholesale markets.

"The price paid by the consumer does not correspond to the cost prices in each country," said French Minister of Economy and Finance, Bruno Le Maire. "It is economic and climatic madness that this should be a function of the price of gas."

He argued that in the face of the volatility of the spot markets, stability is needed, which could be achieved through long-term contracts.

"It is not about reserving electricity produced in France only for French consumers, but that they can benefit from the country's strategic decisions and investments to have decarbonised energy, especially that coming from nuclear power plants. In the same respect, it is normal for the Spanish, who make massive efforts in renewables, to have a return on their investment. It is not protectionism, it is common sense."

Following her call in December for the market to be modified, Spain's Vice President and Minister for Ecological Transition, Teresa Ribera, once again criticized the European Union's management of the energy crisis.

Ribera is seeking consensus among member states to design a pricing system more in line with the current energy mix of European countries. A move she argues would also accelerate the energy transition.

Last month Ribera asked the European Union to apply to the electricity market a criterion similar to the one it has applied in fiscal matters. "The exceptional nature of the electricity market requires the suspension of the rules, just as has been done in the fiscal area with the deficit," she said.

As Russia's invasion of Ukraine continues to put pressure on gas prices, some countries are re-focusing their energy strategies to reduce future dependence on Russian gas.

Last month, France announced plans to build up to 14 new nuclear reactors.

Meanwhile US nuclear plant builder Westinghouse says it has been meeting a number of potential customers throughout Eastern Europe over the last month.

Joel Eaker, Westinghouse Electric Co.'s Vice President for New Nuclear Power Plant Projects was in Poland in February, where he plans to move in

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Cyber attacks show concerning trends

A recent report by Obrela Security Industries has highlighted there was significant growth in the number of cyber attacks last year.

In its 'Security Attack Landscape' report the UK-based provider of security analytics and cyber risk management services, said that email phishing attacks increased by 50 per cent, with banking and finance and healthcare sectors amongst the most frequently targeted institutions.

The report also shows that Europe, Africa and North America are the most frequently targeted areas with the former receiving more than 40 per cent of recorded cyber attacks. Further concerning trends show that cloud attacks on corporate and governance offices rose by 80 per cent as political tensions rise.

An expert from cyber security firm CSS Assure recently warned that businesses could be at a heightened risk of cyber attacks following Russia's invasion of Ukraine.

The warning came as Ukrainian banking and government websites were knocked offline in late February by a spate of distributed denial of service (DDoS) attacks, which are designed to crash sites by bombarding them with excessive requests at the same time, causing server overloads and shutdowns.

UK and US governments claim the attacks were carried out by Russian-backed military hackers

Mike Wills, Director of strategy and policy at cyber and data security firm CSS Assure, said: "Businesses should make themselves as hard to hack as possible at all times – but more so than ever.

"From a strategic perspective, there is a significant risk that Russia may seek to create instability within western countries and, specifically, the UK as a means to distract focus and attention away from the situation in Ukraine and onto closer, acute problems at home.

"In this day and age, this is easier to achieve virtually by means of cyber attacks. To achieve instability and distraction, we may find attacks targeting services that we rely on heavily on a day-to-day basis, such as health, banking, utilities, water, transport infrastructure and supply chains"

At the start of last month Oiltanking GmbH Group and Mabanaft Group said they had been hit by a cyber attack that impacted their operations in Germany.

In a statement, the companies said they discovered a "cyber incident" affecting their IT systems and launched an investigation together with external specialists.

Oiltanking GmbH Group – which operates storage tank terminals for oil, gas and chemicals – said it was still operating all terminals in all global markets. But facilities at Oiltanking Deutschland GmbH, a separate entity that operates all terminals in Germany and is part of Mabanaft, were "operating with limited capacity."

Arne Schoenbohm, the head of Germany's IT security agency, said that 233 filling stations largely in northern Germany had been affected, only 1.7 per cent of the country's total. He said that it wasn't possible at some of those stations to pay by credit card or adjust prices, but that it some cases in was possible to pay using cash.

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the spring. Prior to Poland, he was in the Czech Republic to announce agreements signed with local companies in Cranberry-based Westinghouse's bid to sell its AP1000 reactors in the region. The company is also talking with Slovenia about the prospect of new nuclear reactors there.

Eaker had also visited Ukraine in December, where Energoatom was looking to build four reactors to ensure energy independence, while addressing climate change.

Eaker did not speculate on how the Russia-Ukraine conflict might affect Westinghouse's prospects there. Instead he said momentum is coming from coal-reliant countries that need to reach the climate goals set by their governments. In Poland, about 70 per cent of electricity comes from burning coal. In the Czech Republic, it's around 40 per cent.

For more than two decades, Westinghouse has been seemingly on the verge of selling new nuclear reactors to various Eastern European counties whose energy supplies rely, in large part, on Russia's gas and political whims.

In 2011, Westinghouse lost a construction bid in Lithuania. In 2014, it signed agreements to pursue an AP1000 project in Bulgaria.

Eaker: Westinghouse sees prospects in Eastern Europe for new nuclear plants

When the Czech Republic was entertaining bids for new reactors at its Temelin site, Westinghouse and the US government "pulled out all the stops", said Joyce Connery, former Director of Nuclear Policy at the National Security Council.

Energy, however, has long been instrumental in foreign policy. In 2012, then-Secretary of State Hillary Clinton went to Prague to advocate for the deal. Two years later, the US dispatched its energy secretary, Ernie Moniz, to open a joint US-Czech research centre to boost Westinghouse's chances of competing against a Russian consortium. But the Czechs, torn between Russia and the US, cancelled the project.

Anne Harrington, who served as Deputy Administrator for Defense Nuclear Non-proliferation at the National Nuclear Security Administration between 2010 and 2017, said it is difficult to predict if this recent burst of nuclear promise in Eastern Europe will yield actual new reactor projects.

■ According to the *UNIAN* news agency Prime Minister Denys Shmyhal told Parliament on February 18 that Ukraine was ready to disconnect its power grid from the Russian and Belarusian energy systems and link it to the European network. "Technically, we are almost 100 per cent ready for Ukraine to join the European energy grid in 2023. Experts from the World Bank have estimated the benefits of Ukraine synchronising with Entso-E at $1.5 billion annually."

Investment grows in energy transition but coal use remains stubborn

Europe is struggling to wean itself off coal, as renewables replaced gas during the second half of last year. This is putting pressure on global climate ambitions, writes **Junior Isles**

New renewable generating capacity in the EU largely replaced coal and nuclear during the first half of last year, but since July has instead almost exclusively replaced expensive gas, according to a UK think-tank.

Ember, the London-based non-profit organisation, said coal power in Europe was down by only 3 per cent in 2021 compared with 2019 pre-pandemic levels, far less than the 29 per cent fall recorded in 2019 when compared with 2017 levels.

Weaning the world off coal was a key promise made at November's UN COP26 climate summit, and is seen as a key step in reaching global net zero emissions. According to Ember, EU power sector emissions that cause climate change would need to fall 6 per cent per year to reach the net zero level needed by 2035 but were reducing at about half that rate.

"The current gas crisis should be a huge wake-up call," said Charles Moore, the report's author. "Both coal and gas need to go; and fast."

Ember's findings come in spite of significant growth in renewables investment. According to a report published by BloombergNEF (BNEF) in late January, global spending on the transition to low-carbon energy rose 27 per cent between 2020 and 2021, reaching a new record of $755 billion.

Overall, clean power and electrification, spanning renewables, nuclear, energy storage, electrified transport and electrified heat, drew $731 billion of investment, with the balance of the total figure, or $24 billion, invested in hydrogen, carbon capture and storage and sustainable materials. The renewable energy sector kept top spot in investment terms, showing a rise of 6.5 per cent to $366 billion.

BloombergNEF Head of Analysis Albert Cheung said: "Against a backdrop of rising input costs for technologies like solar modules, wind turbines and battery packs, a 27 per cent increase in energy transition investment in 2021 is an encouraging sign that investors, governments and businesses are more committed than ever to the low-carbon transition, and see it as part of the solution for the current turmoil in energy markets."

Nevertheless, BNEF also stressed that investment levels are below what is needed for reaching global net zero by 2050. It says investment needs to roughly triple to an average of $2.1 trillion per year in the 2022-2025 period to get on track for its net zero scenarios. Investment then needs to grow to an average of $4.2 trillion between 2026 and 2030.

In January, Alok Sharma, urged countries to deliver on the commitments made in the Glasgow Climate Pact. In his first major speech since COP26, the COP President, said: "All in all, there is no doubt that the commitments we secured at COP26 were historic. Yet, at the moment they are just words on a page. And unless we honour the promises made, to turn the commitments in the Glasgow Climate Pact into action, they will wither on the vine."

Commercial fusion begins to look possible

The long held promise of nuclear fusion inched closer as recent breakthroughs moved the technology closer to commercialisation.

Last month the UK-based JET laboratory surpassed its own world record for the amount of energy it can extract by fusing together two isotopes of hydrogen. The experiments produced 59 MJ of energy over five seconds – more than double the 22 MJ achieved in similar tests in 1997.

"The JET experiments put us a step closer to fusion power," said Dr Joe Milnes, the head of operations at the reactor lab. "We've demonstrated that we can create a mini star inside of our machine and hold it there for five seconds and get high performance, which really takes us into a new realm."

Although the energy output is not huge the achievement validates design choices that have been made for an even bigger fusion reactor now being constructed in France. The ITER facility in southern France is supported by a consortium of world governments and is expected to be the last step in proving nuclear fusion can become a reliable energy provider in the second half of this century.

Fusion produces energy in the same as the sun. It works on the principle that energy can be released by forcing together atomic nuclei rather than by splitting them, as in the case of the fission reactions that drive existing nuclear power stations.

In all experiments so far, the energy input exceeds the output but it is hoped that the ITER facility will overcome this. The commercial power plants that come after should then show a net gain that could be fed into electricity grids.

As part of the road to commercialisation, the UK plans to build a prototype, the location of which will be confirmed later this year.

In another significant development, in late January the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory in California, US, validated a way to produce laser-driven nuclear fusion energy, in which a plasma is heated and compressed.

A critical step toward fusion is to have a net energy generator, a burning plasma in which nuclear fusion is the main source of heat to keep the fuel in a plasma state hot enough to allow further fusion reactions.

In landmark experiments a team of US scientists created a burning plasma using deuterium and tritium, two isotopes of hydrogen. In a burning plasma, the particles produced when the nuclei fuse become the main source of plasma heating. The researchers demonstrated the process in four experiments that generated more than 100 kJ of energy. In one case, they were able to extract 170 kJ of energy from a millimetre-sized sphere containing less than one milligram of hydrogen isotopes.

The energy produced was modest, equivalent to batteries that power smoke detectors and other small devices, but the experiments represented a milestone.

"If you want to build a fire, you want the fire to heat up enough so that the wood can keep burning. This is a good analogy for a burning plasma, where fusion is starting to become self-sustaining," said Alex Zylstra, an experimental physicist on the project, which is part of the US DOE.

Industrial giants from the private sector are now also joining the fusion race. Last year, the sector attracted more than €2.3 billion in venture capital funding, predominantly for companies based in the US.

At the start of February Munich-based Marvel Fusion signed partnerships with Siemens Energy, France's Thales and the privately owned German mechanical engineering group Trumpf, while also raising €35 million in a funding round led by tech investor Earlybird.

Elsewhere, Kyoto Fusioneering said it plans to build the first nuclear fusion power plant in Japan capable of producing electricity, an experimental project for which the firm has so far raised 1.7 billion yen ($14.7 million).

The company, based in the Kyoto prefecture, aims to start operating the plant within the next five years, its CEO Taka Nagao said in an interview published by *Kyodo* news.

EU sets out roadmap to accelerate offshore wind

In a report adopted by the European Parliament, the Members of European Parliament (MEPs) have charted out a roadmap on faster deployment of offshore wind. This is in line with the 'EU Offshore Renewable Energy Strategy', which sets out the goals of reaching 60 GW of installed offshore wind capacity by 2030 and 300 GW by 2050.

The report stresses that meeting the 2030 and 2050 targets requires faster deployment of offshore renewable energy (ORE), but maritime space and coasts must be managed more sustainably. MEPs say that a net zero emissions economy requires renewable energy to be deployed on an unprecedented scale, and stress the urgency of improving and expanding existing infrastructure. Many member states are lagging behind in the necessary switch to renewables, they say.

MEPs highlighted the importance of shortening permitting processes and have called on member states to set up a transparent process and consider introducing time limits for issuing permits where necessary.

Lead MEP Morten Petersen commented: "Today's vote shows that we all understand the urgency of the matter and that we are putting offshore renewable energy front and centre in the fight against climate change. We need to introduce time limits, and remove the many barriers that are still standing in the way of a fast and successful integration of renewables in Europe."

Major Chinese investment to speed up Argentina's clean energy rollout

■ Long-planned new nuclear project to go ahead ■ Solar also supported by corporate PPAs

Janet Wood

China is set to step up its funding to Argentina's energy sector, with a new $35 billion deal for infrastructure projects under a five-year investment plan largely aimed at new large energy projects.

The Chinese money will be used to build Argentina's fourth nuclear power plant, Atucha III and the Nestor Kirchner and Jorge Cepernic hydroelectric dams, both in Santa Cruz state, according to recent reports, and expand the 300 MW Cauchari solar farm, which could be more than doubled in size to 715 MW. Other projects in the investment plan include the Arauco wind farm and a gas pipeline.

Argentina and China have already announced an agreement to construct Atucha III, which is the centrepiece of the collaboration and would be Argentina's fourth nuclear power plant. State-owned energy company Nucleoeléctrica Argentina and the China National Nuclear Corporation signed a contract for construction of a 1200 MW reactor.

That project, part of the government's 'Nucleoeléctrica Plan,' will require an investment of more than $8 billion and will see a Chinese-design HPR-1000 reactor built at the site. Nucleoeléctrica President José Luis Antúnez stressed the importance of advancing the project, "so that we can supply Argentina's electricity demand with basic, clean, safe, and sustainable energy, and combat the effects of climate change that affects the planet."

The existing Cauchari solar farm, which came online in September 2020, was built by PowerChina's subsidiary Shanghai Electric Power Construction and partly funded by Export-Import Bank of China. If its expansion goes ahead it will once more be Argentina's largest solar farm.

In the meantime, that title may be equalled by plans for the 300 MW Zonda solar farm, being built by YPF at a cost of $90 million and due to start up at the beginning of 2023. YPF President Sergio Uñac said the project woud double the amount of solar panels in the San Juan province "This investment could have been in any other province, but with the irradiation conditions of San Juan they decided that it should be here," he said.

Martín Mandarano, Chief Executive of YPF Luz, said YPF Luz has been investing in power generation since 2013, first with natural gas, which he said is the "bridge" between conventional and renewable energy, and then with wind projects, which now total 400 MW. "Today we are launching our first solar project in San Juan, where irradiation is among the strongest in the world. We have measurements that allow us to confirm that it is one of the points that competes with the Atacama Desert, which will allow us to develop a highly efficient project," he stressed.

Some 40 per cent of the solar farm's generation is already committed to nearby companies linked to mining and other services.

Brazil sees a variety of energy finance sources

Recent energy financing deals in Brazil reveal a new mix of funding streams.

Chlorine for water treatment in Brazil's Minas Geras state will be produced using solar PV after Atlas Renewable Energy won a $76 million loan from Brazilian banks for the Lar do Sol – Casablanca II plant. Water company Unipar will co-invest in the 239 MW plant. "Projects like these are great examples of long-term relationships between a renewable energy generator, a financer and a client," said Luis Pita, General Manager for Atlas Renewable Energy in Brazil.

Meanwhile, Brazilian utility Neoenergia has recently sealed a deal with the European Investment Bank (EIB) for up to $225.2 million in financing for 1187 MW of wind and solar projects. The ten-year loan will fund the 566.5 MW Oitis and 471 MW Chafariz wind farms and the 148.3 MWp Luzia solar park.

Finally, state-backed company Eletronuclear recently signed a contract with the consortium of Ferreira Guedes, Matricial and ADtranz to resume civil works at the 1.25 GW Angra 3 nuclear project. Another tender is expected to be launched to complete the civil works and electromechanical assembly of the plant. Nearly 70 per cent of the plant has been constructed by Eletronuclear and its previous partners. The facility is expected to commence operations in 2027.

Mexican President denies shift to state-owned power company undermines US players

Mexican President Andrés Manuel López Obrador has denied that his plan to favour Mexico's state-owned electricity company will affect US companies.

The plan guarantees Mexico's government-owned electrical utility a market share of "at least" 54 per cent, even though the US-Mexico-Canada free trade pact prohibits favouring local or government businesses.

US Energy Secretary Jennifer Granholm demanded respect for US energy companies that have investments in Mexico, saying the US had "openly expressed the Biden-Harris administration's concerns about the potential negative impact of the electricity reform on US investment in the country." But Obrador said the plans "don't affect the treaty at all."

The US embassy in Mexico recently said: "The US government has repeatedly expressed concern about Mexico's current energy sector proposal. Promoting the use of dirtier, outdated and more expensive energy over renewable and efficient alternatives would disadvantage both consumers and the overall economy."

A bill submitted in October last year to implement the plan would cancel contracts under which 34 private plants sell power into the national grid.

The plan would also declare "illegal" an additional 239 private plants that sell energy directly to corporate clients in Mexico. Almost all of those plants are run with renewable energy sources or natural gas, often affecting foreign companies.

Chile moves away from fossil backup

In a new approach, Chilean energy commission CNE has said bidders cannot use fossil fuels to back up capacity bids in an upcoming supply auction.

The 2022 power auction will place contracts for 5250 GWh of electricity per year in the form of 15-year power purchase agreements between 2027 and 2041. A variety of low-carbon assets including converted coal plants and renewables can participate, with energy storage schemes as a bid component. Contracts are expected to be awarded by Q3 2022.

Chile's 2021 auction saw more than two dozen domestic and international power players place bids for 2310 GWh/year and was more than eight times oversubscribed. Five companies offered power from new wind, solar and storage projects but were allowed to back up the firm contracts with non-renewable sources.

Meanwhile, neighbouring Peru is set to launch renewable energy capacity auctions for up to 2000 MW. Eduardo Gonzalez Toro, Minister of Energy and Mines (Minem), said bidders were expected to invest $2 billion in solar and wind energy. Peru is following Latin American trends for large renewable energy and are expected to reduce costs, which will allow Peru to lower its energy prices. Peru's current estimate is that it has potential to develop up to 6 GW of renewable energy.

US pursues clean energy options outside infrastructure bill

President Biden has been meeting leaders of the largest US electricity utilities to try to push forward his $550 billion plan to tackle climate change, while other measures in his $1.75 trillion spending package are in abeyance. The comprehensive package was stymied last year by disagreements among Senate Democrats.

Meeting the chief executives, Biden said of his climate plan: "It's going to make us more economically competitive while reducing pollution and improving public health and helping us meet the moment on climate change."

Among the new measures that can go ahead, the Biden administration has revived an Obama-era measure to issue clean energy loan guarantees. The Energy Department said it would guarantee up to $1 billion in loans to help a Nebraska company scale up production of 'green' hydrogen.

More broadly, the administration will invest $8 billion in regional green hydrogen plants, with $1 billion for electrolysis technology and $500 million for green hydrogen recycling projects.

"The Administration's position is that green hydrogen has greenhouse gas emission reduction potential," said senior officials.

Complementing that investment, the DOE's Office of Fossil Energy and Carbon Management (FECM) recently announced up to $96 million for projects developing carbon capture technologies for gas fired power plants and industrial applications.

"The recent development of next-generation carbon capture technologies, targeted to be commercially ready by 2025, has reduced the projected costs for carbon capture in power generation applications," said Acting Assistant Secretary of FECM Jennifer Wilcox.

There is also support for solar. A new Act from the US House of Representatives, 'America COMPETES', aims to improve the country's solar supply chain and competitiveness. It includes $3 billion during 2022-2026 to help establish a domestic solar manufacturing supply chain, expected to include grants and loans for new solar component factories and retrofitting or expanding existing facilities.

"This legislation strengthens our nation's supply chains so more critical goods are manufactured here in the United States instead of China," said Energy and Commerce Committee Chairman Frank Pallone, Jr.

New Mexico regulators recently approved a plan to use new solar generation to replace the 114 MW lost when Public Service Co. of New Mexico stops buying electricity from the Palo Verde nuclear plant.

Meanwhile states have taken on low-carbon plans. California alone has said it will target 25.5 GW of renewables and 15 GW of new storage and demand response resources by 2032, including 17 506 MW of utility-scale solar, 13 571 MW of battery storage, 3531 MW of wind, and geothermal, pumped storage, demand response and biomass resources.

Australia embracing shift to clean energy

- Project EnergyConnect link to drive significant investment in renewable energy
- Eraring coal fired plant to close early

Syed Ali

Australia continued to demonstrate its commitment to shift to clean energy, with several recent announcements that will cut the country's carbon emissions and facilitate the integration of renewables.

In mid-February major construction work kicked off on Project EnergyConnect, a 900 km interconnector between South Australia and New South Wales (NSW).

South Australia expects the 800 MW link to drive significant investment in renewable energy in the state and help make it a renewables export force, contributing to its target of net 100 per cent renewables by 2030.

"Project EnergyConnect is a key project of national significance that will help improve the affordability, reliability and security of electricity supply for South Australians and strengthen the National Electricity Market," said ElectraNet interim Chief Executive Rainer Korte.

Construction of the 206 km section in South Australia is expected to be completed in late 2023.

The start of construction came as NSW proposed to close the country's largest coal fired power station seven years earlier than planned. The Eraring power plant's operator said it is increasingly unable to compete with the "influx of renewables".

The Eraring power station, located on the central coast of the state of NSW and operated by Origin Energy, will close in 2025 and be replaced by a large-scale battery.

"Australia's energy market today is very different to the one when Eraring was brought online in the early 1980s," Origin CEO Frank Calabria said in a statement.

Calabria said the pressure generated by cleaner and lower-cost energy generation, including solar, wind and batteries in the coal-reliant country, is accelerating the exit from coal fired generation, forcing them to update the services.

To support the transition to renewables, NSW Treasurer and Energy Minister Matt Kean said the state will install the massive new 'Waratah super battery', a 700 MW/1400 MWh grid battery together with other minor transmission upgrades, will allow Sydney, Newcastle and Wollongong consumers to access more energy from existing electricity generation.

The new grid battery is also expected to be the largest network standby battery in the Southern Hemisphere.

NSW government said it will also accelerate its Electricity Infrastructure Roadmap to "keep energy prices affordable". Under the roadmap, the government will invest A$84 million ($60.4 million) in the key bodies needed to accelerate the implementation of the roadmap and establish a transmission acceleration facility.

Earlier last month, a $600 million gas fired power plant in the NSW Hunter Valley received its final environmental approval.

The Hunter Power Project, due to be built by next year, would ensure ongoing reliable and affordable power for the people of NSW when the Liddell coal fired power station shuts, said Federal environment Minister Sussan Ley.

Labor agreed to support the project as long as it runs entirely on green hydrogen by 2030.

South Korea moves to boost renewable projects

South Korea has opened the door for direct Power Purchase Agreements (PPAs) for renewable projects in a move aimed at accelerating growth in the sector.

Last month it was announced that amendments to the Electric Utility Act – which for the first time allow renewable energy generators in South Korea to sell electricity directly to end-users without having to go through the Korean Power Exchange (KPX) – are now in force.

Under the pre-existing electricity market structure, direct PPAs between generators and end-users were prohibited under the Electric Utility Act. Instead, generators were required to sell into the KPX's hourly auction pool, with Korean Electric Power Corporation (Kepco) as the sole offtaker (given that Kepco is the only 'electric sale business' licenced under the Electric Utility Act).

The amendments are seen as a potential game changer for the renewables sector, since they effectively remove Kepco's monopoly on the sale of renewable energy to end-users.

Notably, the changes come as South Korea ramps up its offshore wind power efforts.

In late January the government awarded an electric business licence (EBL) to Korea Floating Wind, a joint venture (JV) between Ocean Winds (a JV between EDP Renewables and Engie) and Aker Offshore Wind granting exclusive rights to develop a 870 MW floating wind project off the coast of Ulsan.

The JV has identified three sites off Ulsan's shore that can accommodate some 1.2 GW of floating wind power capacity. Korea Floating Wind expects to secure its second EBL for 450 MW capacity. Financial close is expected in 2024.

Meanwhile, at the end of January Doosan Heavy Industries & Construction installed its 8 MW offshore wind turbine prototype at the Korea Wind Power Demonstration Centre in Baeksu. According to Doosan Heavy, its prototype is Korea's largest wind turbine to date.

Doosan Heavy expects to obtain international certification and prepare to complete the machine's commercial launch in June.

Climate concerns following removal of wind and solar subsidies

China's decision to end many subsidies supporting wind and solar could discourage the use of cleaner sources of energy and adversely impact the fight against climate change, according to Canada based think-tank International Forum for Rights and Security (IFFRAS).

IFFRAS says that in the past, China's subsidy policy was mostly to cover excessive installation and production costs of renewable energy. However, as of August 1, 2021, new solar power stations, distributed solar projects by commercial users and onshore wind projects stopped receiving grant subsidies from the central government budget.

IFFRAS argues that the withdrawal of the subsidies will lead to reduced consumption of wind and solar energy and increase pressure to use fossil fuels, leading to higher carbon emissions.

Notably, however, China continues to make significant progress in offshore wind. A report released in February by World Forum Offshore Wind (WFO) states that the country connected 12.7 GW of new offshore wind capacity to its grid last year. This is 4.2 GW less than reported in January based on data from China's National Energy Administration.

The difference between the figures of China's National Energy Administration and those reported by WFO is due to definition of operational capacity. WFO noted that it counts offshore wind capacity in operation, as that where all turbines are installed and first power was produced.

China saw steady growth in renewable energy capacity in 2021, data by the National Energy Administration showed. By the end of last year, the country's installed capacity of renewable energy totalled 1.06 TW, accounting for 44.8 per cent of the total installed power generation capacity.

Philippines accelerates renewables

The Philippines is looking to significantly boost its renewable generating capacity as it officially kicked off the tendering process for 2000 MW of renewable energy (RE) capacity. The new capacity will be accredited in the government's Renewable Portfolio Standards (RPS), a market mechanism that will guarantee revenue stream for project developers via power supply agreements (PSAs) with distribution utilities.

The Green Energy Auction Committee (GEAC) of the Department of Energy (DOE), which launched the tendering process, said in late January that it is inviting "all qualified suppliers to participate in the first round of the 'green energy auction' for RE."

Based on the tender notice, project developments will be spread across grids in Luzon, Visayas and Mindanao and shall cover various RE technologies – including hydro, biomass, solar and wind projects.

Solar will take the biggest share of the generating capacity, with 1260 MW being targeted – 900 MW in Luzon; 260 MW in the Visayas; and 100 MW in Mindanao.

The news came as Solar Philippines Nueva Ecija Corp. (SPNEC) said it is looking to conduct a stock rights offering and forge more partnerships, as it plans to develop 10 GW of solar projects.

SPNEC's plan represents an almost 10-fold increase in the country's current grid-connected solar capacity of 1.021 GW (as of December 2020), based on Department of Energy (DOE) figures. SPNEC said solar projects of this scale would only be made possible by partnering with the country's leading power companies.

After solar, wind will be the second most important RE source in the 2000 MW tender, with the government soliciting tenders for 380 MW of wind capacity – 360 MW for Luzon and 20 MW for Visayas. There is no allotment for now in the Mindanao grid.

The DOE estimates that the Philippines has an offshore wind power potential of over 170 000 MW, or more than enough to cover the country's entire power needs.

- Battery storage specialist Fluence Energy Inc. has started commercial operation of the first 20 MW/20 MWh battery of a 470 MW/470 MWh portfolio. The Kabankalan system is the first directly controlled by the National Grid Corporation of the Philippines to deliver grid stability services. Fluence is deploying the portfolio for SMC Global Power Holdings Corp, the power business of Philippine conglomerate San Miguel Corp. In June 2021, Fluence says it has completed commissioning of the first two batteries in the portfolio.

France leads Europe's nuclear power supporters with bet on expansion

■ Finland, Poland at opposite ends of build process ■ Bulgaria abandons plans for Belene

Janet Wood

French President Emmanuel Macron has announced plans for ambitious new nuclear construction, saying that between six and 14 new nuclear reactors should be built.

The new announcement is a reverse of the Energy Transition for Green Growth act, passed in 2014, which limited France's nuclear power capacity to 63.2 GW, so that new capacity could only be built if another reactor was shut down. That was the basis on which Flamanville 3 is being built: it replaces Fessenheim, which shut in 2020. But now, Macron has said that none of France's 56 operational reactors would be shut down except for safety reasons.

The shift will also be of interest to neighbouring countries, some of which are consistent importers of power from France.

The shift moves renewables from the centre of France's future energy policy, but they are still a major part of its energy programme. Macron reinforced that message by promising that France will have around 40 GW of offshore wind capacity in operation by 2050.

In a recent speech President Macron highlighted wind's importance to France's industrial strategy. "As of this year, we will be commissioning the first offshore wind farm off Saint-Nazaire," he said, promising to set aside €1 billion to help develop emerging technologies such as floating wind.

"We will continue to develop industrial employment and investments there too so that these strong choices for offshore wind power are accompanied by the creation of jobs everywhere on our territory," he added.

France plans to put 8.75 GW of offshore wind capacity out to tender by 2028, by which time it will already have up to around 12.4 GW of fixed-bottom and floating offshore wind capacity either in operation or under development.

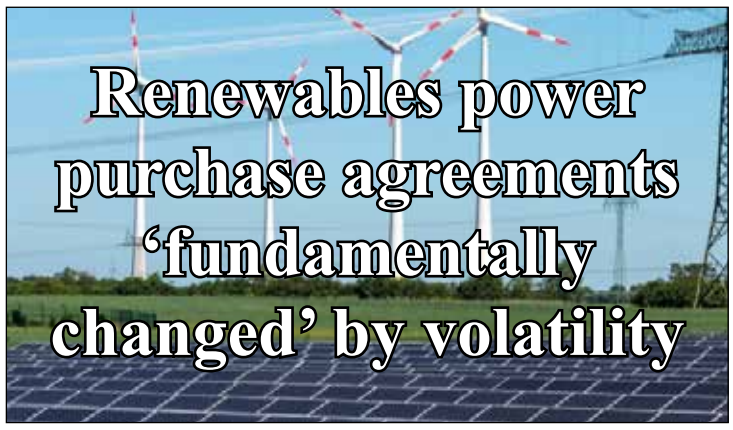
Elsewhere, startup of Finland's new Olkiluoto 3 nuclear power plant was postponed again recently, to the end of February, and commercial operation is now planned for July 2022.

In Poland, US-company Westinghouse Electric Company signed memorandums of understanding with 10 companies on cooperation on the potential deployment of AP1000 in Poland and elsewhere.

In contrast, Bulgaria has decided not to go ahead with construction of a new 2GW nuclear plant at Belene.

Prime Minister Kiril Petkov told the *BBC* that instead, the country "will consider the possibility" of building new reactors at the Kozloduy nuclear power plant. He said Bulgaria will contact its neighbouring countries as potential energy buyers.

Plans for a Russian-supplied plant were abandoned in 2009 but in June 2020, Rosatom, Framatome SAS and GE Steam Power signed memorandums of understanding participating in a competitive process. That has been abandoned.



Renewables power purchase agreements 'fundamentally changed' by volatility

The market for renewable energy Power Purchase Agreements (PPAs) is being fundamentally changed by the recent volatility and spike in power and gas prices, according to Pexapark.

In a recent market survey of 2021 it said prices had spiked five times higher than usual, and PPA activity in renewable energy had grown as much as 58 per cent.

Pexapark says the recent market turmoil will have lasting effects and will "test the availability and pricing for long-term PPAs of 10 years or more", raising interest in short-term PPAs. It will also drive the rise of 'next generation utilities'.

The year saw corporates secure a greater number of PPAs than utilities, reaching 6.5 GW compared to 4.6 GW for utility PPAs. Pexapark says corporates such as global data centre operators, chemical companies and consumers such as green hydrogen suppliers, have "gargantuan energy needs" that are likely to be sourced from offshore wind farms alongside equity investment.

Luca Pedretti, Chief Operating Officer, Pexapark, said: "The findings of our 2022 Market Outlook strongly indicate that operating models for renewable energy sales and risk management are going to be needed to keep pace with the impact that volatility is having on the market.

"Sustained and continuous high volatility of capture rates highlights the need for more active management of asset revenues."

Hydrogen projects multiply in numbers and size as industry seeks green feedstock

■ Projects stepping up from megawatt to gigawatt scale
■ Offshore opportunities pursued

Janet Wood

Green hydrogen projects in Europe are stepping up as companies across the continent look for low-carbon feedstocks for industrial users.

Finnish hydrogen and synthetic fuel producer P2X Solutions recently said it will invest €70 million to construct Finland's first industrial-scale green hydrogen production plant. Investment includes €5 million equity investment and a €20 million shareholder loan from German asset management firm Prime Capital.

Construction of the 20 MW green hydrogen production plant will begin in autumn 2022 and it is due for completion in 2024.

The P2X plant is seen as the first of a series, but it is a tenth the size of a new project announced for Maasvlakte, in the port area of Rotterdam in the Netherlands. On that site electrochemical company Nobian is joining with BP on a 250 MW green hydrogen project dubbed 'H2-Fifty'.

The output will replace fossil-based feedstocks at BP's refinery and a final investment decision is expected next year.

In turn the Netherlands project is a tenth the size of Project Catalina in Spain's Aragon region. Here Copenhagen Infrastructure Partners, Enagás, Naturgy, Fertiberia and Vestas intend to develop 5 GW of wind and solar, and use it to produce green hydrogen via a 2 GW electrolyser.

Other projects are seeking offshore sites. RWE has joined forces with Neptune Energy to step up green hydrogen production in the Dutch North Sea. The so-called H2opZee demonstration project will have electrolyser capacity of 300 MW to 500 MW, which will export hydrogen via an existing pipeline.

The new agreement aims to develop the H2opZee project by 2030. The partners say the potential hydrogen pipeline has a capacity of 10-12 GW, "so it is already suitable for the further roll-out of green hydrogen production to gigawatt scale in the North Sea".

Feasibility studies will start in the second quarter of 2022. Sven Utermöhlen, Chief Executive of Offshore Wind at RWE Renewables said: "Hydrogen is a gamechanger in the decarbonisation of energy-intensive sectors, and H2opZee is among the world's first projects of this kind and scale.

"With Neptune Energy at our side, we want to develop the H2opZee project to demonstrate how offshore wind can be an ideal partner for the production of green hydrogen at scale, and to explore the best approaches to system integration."

As more, and bigger, green hydrogen projects are announced, DNV has joined 18 industry partners to improve standardisation for green hydrogen using electrolysis.

Kim Sandgaard-Mørk, Executive Vice President for Renewables Certification at DNV, said: "DNV predicts that hydrogen will move from approximately 1.9 per cent of the mix of energy carriers in 2040 to 5 per cent in 2050, a trend that DNV anticipates will continue into the second half of the century."

EU Taxonomy proposal gives green light to gas and nuclear

The nuclear and gas industries are celebrating inclusion in a new proposed 'Taxonomy' from the European Commission that places them inside its portfolio of clean technologies. The decision makes investing in the two industries much less problematic.

COGEN Europe Managing Director Hans Korteweg said: "This sends a positive signal to investors and to policy-makers that they should see cogeneration as an enabling technology for the cost-effective and efficient decarbonisation of our energy system.

"World Nuclear Association Director General Sama Bilbao y León said it was "a hugely important milestone that the international financial community cannot afford to ignore."

But the Taxonomy disappointed climate campaigners. Laurence Tubiana, Chief Executive of the European Climate Foundation, said: "The EU Taxonomy was envisioned as a vital tool to align financial flows with the Paris Agreement. Instead, Europe is undermining its climate leadership and lowering standards in the EU and beyond. When a gold standard does emerge elsewhere, this Taxonomy will be left behind."

The EU Member States and the European Parliament have up to six months to scrutinise the Commission's proposal and have the power to reject the proposed regulation.

New interconnector funded to link Cyprus and Greece

EU member states have agreed with a Commission proposal to invest €1.037 billion in five cross-border infrastructure projects under the Connecting Europe Facility (CEF).

The biggest single tranche of funding is €657 million for the so-called 'EuroAsia interconnector' which will connect the transmission networks of Cyprus and Greece. The 898 km undersea cable will be in seas as deep as 3000 m. The CEF grant comes in addition to a €100 million grant awarded in the Recovery and Resilience Facility instrument.

Kadri Simson, Commissioner for Energy, commented: "Recent months have reminded us again how crucial a well-integrated EU energy market is for ensuring affordable energy and security of supply, as well as the clean energy transition.

"While we have made remarkable progress in the last decade with making our market better connected, more can and should be done. I want to particularly highlight the EuroAsia interconnector, that will bring an end to the energy isolation of Cyprus and link it to the rest of Europe."

Other funding includes grid reinforcement in Poland and upgrading the transmission infrastructure in Lithuania, Latvia and Estonia – supporting the integration of the Baltic states with other European electricity networks.

Cape Town to break away from Eskom power failures

City mayor solicits projects from independent power producers to carve a way out of crippling power shortages. **Nadia Weekes** reports

Cape Town is to source electricity from independent producers, the first South African city to do so and a sign of increased frustration with the government's inability to reform the blackout-prone state-owned Eskom monopoly.

Speaking at the Solar Power Africa conference on February 16, Cape Town mayor Geordin Hill-Lewis announced that the municipality has opened its first round of tenders for the purchase of electricity from independent power producers (IPPs).

"It has become clear to the City of Cape Town that if we wish to halt the damage caused by Eskom's monopoly over electricity generation, we have to take matters into our own hands. The only way for us to provide reliable and affordable electricity to our residents is to source it from elsewhere," Hill-Lewis said in a statement earlier in February.

"Bringing IPPs onto the grid, through the tendering process, is a crucial step in ending load shedding over time. The economic effects of a reliable power supply in Cape Town will mean more profitable businesses and more job opportunities," he said.

Rolling blackouts have crippled South Africa's economy in recent years. Eskom, whose ageing coal plants generate nearly all of South Africa's power, has said it needs 4-6 GW of additional capacity to shore up supply. An emergency procurement for 2000 MW has faltered and is now due to deliver only 800 MW.

Cape Town is looking to procure at least 300 MW of renewable energy in the next 40 months – a fraction of the 2 GW it needs in the peak winter period. This would relieve pressure on the national grid but is insufficient to substantially improve supply. Hill-Lewis said there will be a future procurement for energy storage as well.

Hill-Lewis said he had received "a deluge of offers" to fund the projects. "I'm fairly confident that financing the procurement is not a problem," he added.

Analysts say that some of the $8.5 billion pledged at last year's UN COP26 climate conference to help Africa's biggest carbon emitter to end dependence on coal could be directed towards funding IPPs.

Over the coming months, the City of Cape Town will procure up to 300 MW of renewable energy. It will consider proposals from IPPs for projects between 5 MW and 20 MW. "We will consider proposals from a range of projects, including generation-only projects, generation-plus-storage projects, and storage-only projects," Hill-Lewis said.

Eskom currently supplies less than two-thirds of its maximum available generation capacity to South Africa's grid. The utility's coal plants are on average more than 40 years old. While 2021 was the worst year yet for blackouts in terms of both duration and intensity, it is likely that 2022 will be even worse as the coal fleet continues to deteriorate.

"Everything that you hear about poverty and unemployment in South Africa from politicians is just lip service, when you can't provide electricity for your economy to grow," Hill-Lewis said. "If cities are serious about making an impact on unemployment and poverty, you have to sort out electricity."

Oman inaugurates 500 MW solar PV project

- First solar project to connect to the main national grid
- Electricity for 50 000 homes and 340 000 t/y of CO_2 avoided

Oman's Interior Minister, Sayyid Hamoud bin Faisal al Busaidy, has inaugurated the Ibri 2 solar power project in the Wilayat of Ibri, in Al Dhahirah Governorate.

The product of a public private partnership (PPP) between ACWA Power of Saudi Arabia, Gulf Investment Corporation and the Alternative Energy Projects Company (AEPC), the project was developed on a build-own-operate (BOO) basis at an estimated cost of $417 million.

Electricity output from the plant is committed under a long-term supply agreement to Oman Power and Water Procurement Company (OPWP), part of Nama Group.

Ibri 2 comprises approximately 1.5 million bi-facial solar photovoltaic (PV) panels and extends over an area of 13 million m^2. At full capacity, it will generate enough electricity to meet the requirements of nearly 50 000 homes and avoid 340 000 tonnes of CO_2 emissions a year, when compared with a natural gas fuelled power plant.

The new project is also contributing to socio-economic development in the governorate. A number of local firms benefited from contracts during the construction phase, and several local start-ups are supporting the venture during the operations phase.

The project has been developed in line with strategic national objectives set out in Oman Vision 2040, a wide-ranging 20-year strategic document that includes targets for 20 per cent of Oman's energy to be sourced from renewables by 2030, and up to 39 per cent by 2040.

"As a company that is driving the transition globally, we are extremely proud to play a key role in supporting the Sultanate of Oman's ambitious Vision 2040 energy transition goals," said Mohammad Abunayyan, ACWA Power Chairman.

"Together with our partners Gulf Investment Corporation and Alternative Energy Projects Co, we have leveraged our combined strengths in investments, industry expertise and technological know-how to achieve the rapid and successful completion of the milestone Ibri 2 project, despite challenging conditions imposed by the Covid-19 pandemic," he added.

"Ibri 2 will be a turning point for launching similar projects in the field of renewable energy," said Yaqoob Saif Al Kiyumi, CEO of OPWP.

OPWP is currently developing two solar power plants in Al Dakhiliyah Governorate with a total capacity of 1 GW, as well as wind power projects in South Al Sharqiyah and Al Wusta governorates.

Africa's largest dam goes live in Ethiopia

The first of 13 turbines at the Grand Ethiopian Renaissance Dam is now generating electricity from what will become, on completion, Africa's largest dam on the Blue Nile.

"This is good news for our continent and the downstream countries with whom we aspire to work together," said Ethiopia's Prime Minister Abiy Ahmed.

The $4.2 billion project will have a generating capacity of more than 5 GW by its planned completion date of 2024, helping extend power to many of the 65 million Ethiopians who still live without electricity.

The dam, however, is seen as a threat by Ethiopia's downstream neighbours Egypt and Sudan, because of their dependence on water from the river Nile.

Egypt fears it will suffer from water shortages, especially during periods of drought, and is anxious about Ethiopia's potential plans to build more hydropower dams.

The Egyptian foreign ministry said Ethiopia's "unilateral" start of power generation, coming after the "unilateral" filling of the dam beginning in July 2020, was a breach of a regional commitment to collaborate on the project.

Morocco charts path to 2050 RE target

Morocco's goal to increase the share of renewables in its total power capacity to 52 per cent by 2030, 70 per cent by 2040 and 80 per cent by 2050 rests on a rapid expansion of increasingly cheaper wind and solar capacity coupled with technological advances in energy storage and green hydrogen, according to a report by data and analytics company GlobalData.

The firm forecast Morocco's installed capacity share of coal to decline from 38.8 per cent in 2020 to 22 per cent by 2030, and oil-based thermal capacity to reduce from 16.2 per cent in 2020 to 9.2 per cent by 2030.

Morocco's renewable energy installed capacity is estimated to have reached 4.3 GW in 2021, increasing 9 per cent from the previous year. It is forecast to reach 9.6 GW by 2030 at a compound annual growth rate (CAGR) of 9.3 per cent during the current decade.

Wind power is expected to overtake hydro to become the largest renewable source during this period, with wind's installed capacity expected to increase from 1.4 GW in 2020 to 4.3 GW in 2030. Installed capacity for solar, both photovoltaic (PV) and concentrated solar power (CSP), will increase from 734 MW in 2020 to 2.1 GW in 2030.

"Apart from developing large renewable projects, Morocco should focus on improving its existing renewable energy laws to enable development of small-scale grid-connected renewable systems," said Pavan Vyakaranam, Project Manager at GlobalData.

"Currently, the net metering legislation discourages investments in rooftop PV and small renewable systems other than for self-generation, as it connects only 20 per cent of their annual production to the grid," he added.

According to Vyakaranam, Morocco should also continue to award solar and wind projects under tender auctions, such as the one held in January 2021 by the Moroccan Agency for Solar Energy (MASEN) for the construction of a 400 MW solar power plant – part of the first phase of the Noor PV II project, under which several PV arrays will be built across eight different locations.

Cyber security: part of the resilience equation

As the world transitions to a more digitalised, distributed, energy system, cyber security has to be part of the equation in advancing a more sustainable, flexible and secure electricity system. Hitachi Energy's Pierre-Alain Graf believes this can only happen in a cyber security ecosystem, where information is exchanged responsibly, in real-time. **Junior Isles**

Functioning without electricity is unthinkable in modern society. The impacts of a blackout or even a temporary power cut are huge, not just on every individual but also on the cost to business. Even an hour of downtime can cost a company millions of dollars. In fact, in 2019 the US Department of Energy estimated that outages were costing the US economy $150 billion annually.

Outages caused by extreme weather events in recent years around the world have certainly driven home the urgent need to increase the resilience of power systems. But ensuring security of supply is no longer just a case of strengthening power networks by the addition of new cables, storage devices or backup generators.

As digitalisation increases with the move towards a more sustainable, flexible system, security has taken on another dimension. Ensuring systems are safe from cyber attacks must now be part of any utility energy security programme. Yet is an area in which energy companies are still under-prepared.

The energy sector is among the top three targets for cyber attacks. A cyber attack on a nuclear power subsidiary of Brazil's Eletrobras one year ago, last summer's ransomware strike on the Colonial gas pipeline in the US and more recently a data breach at Danish wind turbine manufacturer in November, all served as reminders of the work the energy sector has to do to improve cyber security.

Some argue that what is needed is greater collaboration, where information on cyber security is shared to build joint resilience. Pierre-Alain Graf, Cybersecurity lead for Hitachi Energy believes this can only happen in a world where information is exchanged responsibly, in real-time. Certainly, he is well positioned to comment on how the sector could move forward.

Graf joined Hitachi Energy five years ago to build the company's cyber security business. With extensive experience in the IT and telecoms sector, and having been CEO at Swissgrid (the electricity Transmission System Operator) for over seven years, Graf has a good feel for the challenges facing grid operators.

Graf: what is needed is greater collaboration, where information on cyber security is shared to build joint resilience

The power system is the most critical of critical infrastructures

His international background, living and working in several countries, also gives him the ability to look at things in different ways – a useful quality, especially when addressing security. Commenting on his role as co-chair of the Workgroup on cyber security within the World Economic Forum (WEF), he noted: "In the World Economic Forum, you get to see things from a broad perspective. We have different groups that might be adversaries at the global level, but they are worried about the same things."

Drawing on his experience at Swissgrid to explain the challenge facing the power industry, he makes two key observations: "Firstly there is a culture in the sector that puts a lot of pride in being responsible for delivering, but at the same time this limits their view," he said. "The second thing is, security is not just one thing – it requires strong cooperation between a multitude of different departments."

"Power systems have been built in a resilient way; they have always been built with a blackout in mind. All simulation, etc., has been built resiliently. But the weakness is that cyber brings in a new dimension of interruption. For example, looking at a system in normal operation from an electricity perspective might reveal a problem in one or two nodes but you can start to focus on the problem. In cyber, the problem can be created in parallel in different nodes."

Cyber is therefore not only a new dimension but presents a single way to disrupt a system. And with the power system being the most critical of critical infrastructures, bad actors potentially have much to gain in executing attacks. Carrying out an attack is merely a case of probing for the weakest link – it could start in a generating facility, substation, in the IT of a back office system or even the computer of an employee logging into that system. A utility could experience millions of automated probes every month as well as 30-40 more advanced probes.

With a growing frequency in cyber attacks, partly driven by an increasing attack surface resulting from digitalisation and decentralisation, Graf says what is needed is a joint ecosystem. He explained this ecosystem from two aspects: technical and operational.

"From the technical aspect, you need several disciplines around a

power network," said Graf. "First you need the electricity discipline – you need to understand how the system works and what the overall system is doing. Here you really need to have a tight control on the operational technology (OT) behind it and the scada (supervisory control and data acquisition) system.

"Secondly, you need to understand the operational context. A network never operates the same way; it has different varying flows. Depending on the flow, you may have to switch the network, put reserve energy in, make sure it's stabilised, etc. You need to understand at which load point in the network or system to employ the mitigation action.

"From an attack standpoint, you need to have the system perspective; you need to go one level deeper – understand what is happening with the OT system, the IT system and the physical security system. You have to be able to analyse across different disciplines. And then implement the mitigation depending on the analysis.

"You then have to put all that know-how together and come up with a concrete resolution."

While all of this can be done, the challenge in an electricity system is that it all needs to happen in a short time. To avoid cascading in a transmission network, an operator might have 20-25 minutes before having to start running the first switching operation to stabilise the system. The overall time from an incident to the start of cascading is about 40-45 minutes.

This calls for a very rapid analysis of all the elements in all the domains of the power network in a very short time frame, including switching commands.

"An ecosystem brings all of the disciplines – OT know-how, IT design security know-how, physical security – and activates this analysis all in parallel to stabilise the network if there is a cyber attack," said Graf.

The challenge, however, is that there is no one company that has an in-depth understanding of all these disciplines. In a recent article from Hitachi Energy, Graf referenced one of the company's partners, Deutsche Telekom, to illustrate the level of understanding needed. As a tier-one telecom operator, the company owns a telecom network in which it is the top-level operator. As Germany's dominant internet service provider the company encounters a massive amount of cyber activity, much of which requires careful scrutiny. This can only be done by companies immersed in their specific field.

"Worldwide there are perhaps 5-6 domains set up every second. The vast majority are domains probably set up for staging some form of illicit attacks. So you need some type of machine learning skills to quickly determine and block rogue sites and take mitigation action to de-register them. It's a continuous process and this is just one of the cyber expertise you need to have. This requires a lot of visibility, know-how and deep understanding," said Graf.

The same is true of the OT aspect. While many companies can install a sensor in a substation that reads OT protocols to generate an alarm, understanding the nature and cause of the alarm requires much deeper knowledge.

"Was the alarm just a control issue between two devices? Was the communication flow between the two devices illicit or not? And what was the trigger behind it? This needs advanced understanding," explained Graf. "And if you go one level deeper to ask why one server is speaking to another, that requires quite an advanced level of substation experience."

There is a growing frequency in attacks, partly driven by an increasing attack surface resulting from digitalisation and decentralisation

He says the same applies to physical security. "While anyone can inform the police if they see someone behaving strangely, in the context of cyber – which also has a physical security element – again it is speed that matters. Not only do you need to recognise whether something is going wrong, you need to be able to quickly analyse whether anything is happening in my electronics systems."

In a traditional utility, these three disciplines are in different organisational units and the human collaboration between them takes time.

Hitachi Energy believes an ecosystem approach to cyber security – where it brings together a deep level of expertise with three "control centres" connecting each process or discipline – delivers huge benefits to its customers.

"Control room operators can see what is happening on a network each millisecond but most are blind to the cyber aspect. They don't know if everything is under control; but that is where we eventually have to get to," said Graf. "Security should be just another checkpoint in the [electricity] control centre."

The final part of the ecosystem, says Graf, is information sharing. If there is an incident within an organisation, it should be shared with your peers. This avoids the same problem occurring in another organisation. The challenge with this, however, is that security breaches carry a certain "shame factor", which means the natural reaction is to not share.

Graf says, the ecosystem is therefore also about finding a safe environment where a utility can share information, knowing that it is safe. What is needed, argues Graf, is a trusted intermediary with the necessary power and justification to do deep level sharing.

"It's about being able to share information, knowing that I will not be abused," he said. "The way we can do it is, if there is an attack somewhere, it is put in the field for all the other systems. If there is an attack pattern, all the other customers will benefit. So this information sharing and working with each other beyond the normal way is also part of the ecosystem."

How to share information, however, is a delicate question, to which there is as yet no broadly accepted answer.

The first possibility is through a state organisation. But if utilities are regulated by the state it is unlikely there will be deep level sharing.

"If you share information with someone that supervises you, there will be some tension," said Graf. "This is evident in the fact that government organisations have not developed the platforms or forums needed. Even in the US, which has put a big focus on information sharing in the cyber space, the solution has not yet been found. But I believe that if I'm in a network system sharing with my peers, it will help. They will understand me because we are all in the same operating position."

Graf has a dream. "We have a Geneva Convention on Warfare. My personal dream is that somewhere down the road, we have an amendment for non-attack and protection of critical infrastructures in the power sector. But it's not something Hitachi Energy can do; this would be for diplomats."

Graf admits this may be idealistic but says the industry must get to a position where there is such a sharing between operators. For the electricity sector this calls for a complete change in mind-set and goes against how the industry was created.

Graf explained: "What has been done in the electricity sector for decades, is that it's set-up for independent operation, where the 'expert' is

Control room operators can see what is happening on a network each millisecond but most are blind to the cyber aspect

Several disciplines are needed around a power network. Operators must first have tight control on the operational technology

the king. Although, understandable, this creates the mind-set of not to share."

In an effort to change this behaviour and promote a resilient ecosystem, Hitachi Energy is taking a two-pronged approach.

The first is through discussions, stakeholder management, positioning and thought-leadership papers. The company is very active in the WEF's Cyber Resilience Group.

"Hitachi Energy has been around for a long time with innovation. But also, if we think something needs to be changed, we will talk about it. So we share our position," said Graf. "As a co-chair within the cyber group in the World Economic Forum, we try to drive initiatives within the industry as far as we can within the boundaries of commercial restrictions. This is a moral obligation and stakeholder influence communication is an important part."

The second part of its drive towards an ecosystem is based around concrete technology and service delivery for the industrial cyber security sector.

"When I first started in the company, it took us a while to set up this service because we tested everything in the field with customers. The only way to convince stakeholders and really have an impact is to change operational processes, behaviours and tools. We think we are quite advanced with our idea to integrate different security dimensions. But we will still need to prove that this is the right way to go," Graf said.

Notably, when the company built its pilots with customers, it asked an independent company to interview each customer for insight on the security level before and after. Almost all said they saw an improvement in every area. Satisfaction has been extremely high and every security dimension has moved up by 1-3.5 notches on a scale of 1 to 5.

"When asked why, they said they had been learning a lot about why we were conducting these pilots," Graf commented. "So the way to change behaviour is to experience the difference. And this can only be through implementing and operations, and talking at the operating level."

Looking forward, Hitachi Energy believes it has the know-how to help the industry overcome some of the tricky problems at the operator level, e.g. in sharing information as well as driving the analysis of information, within commercial limits.

The way forward could be to create this ecosystem between manufacturers, operators and perhaps government bodies.

The next level, says, Graf would be to then have this on a "machine base" so the industry can develop algorithms and share machines, which can react very quickly. He noted: "It's easier to keep confidentiality in machines than between human beings."

Looking at what can be done right now, he added: "Our mission is to provide technology and help society with sustainable networks that get us through the energy transition. Everything else is not our [core] mission. But it is something we can do in the context of our mission and we have started to do it."

The company says it is also building close collaborations to address the various needs of the industry.

Graf divides Hitachi Energy's ongoing efforts in building cyber security into two areas – products and operation.

In the products domain, the company will continuously use innovation to develop technology that will get confidentiality and security into its systems.

For example, in the future such technology will include quantum safe cryptography. Without quantum-safe cryptography and security, all information that is transmitted on public channels now – or in the future – is vulnerable to eavesdropping. Even encrypted data that is safe against current adversaries can be stored for later decryption once a practical quantum computer becomes available. Quantum safe cryptography is a new generation of the public-key cryptographic system based on hard mathematical problems that even large quantum computers cannot break.

In the area of operation, Hitachi Energy has embarked on a global certification programme for security. This is particularly important when there is a system integration or custom design.

Graf said: "We started last year and now have all the major countries certified to ISO/IEC 27001. We are also certifying the products, system integration units according to IEC62443."

ISO/IEC 27001 is an international standard on how to manage information security. It details requirements for establishing, implementing, maintaining and continually improving an information security management system. IEC 62443 is an international series of standards that address cyber security for operational technology in automation and control systems. The standard is divided into different sections and describes both technical and process-related aspects of automation and control systems cyber security. It divides the cyber security topics by stakeholder category/roles including: the operator, the service providers (service providers for integration and for maintenance) and the component/system manufacturers.

Graf says Hitachi Energy is taking a systematic approach. It has a team of 10 dedicated people – half doing assessment and the others working with independent auditors on the certification process – working on the programme and using any lessons to make continuous improvements. This day-to-day work also includes vulnerability management, where the company has embarked on a programme to take this to the next level.

"It may sound like nothing but it's a very important area for the sector. Like our competitors, we have the responsibility to deliver what is needed to the customers," said Graf.

Engagement in stakeholder management in forums such as those run by the WEF or CISA (Certified Information Systems Auditor) will help bring the key topics to the table. "We will be putting our energy into such forums to really drive the security topic," said Graf.

He added: "But we can't do it on our own and we are humble enough to recognise that it needs broad participation. We, at Hitachi Energy, will not save the world on our own from this – the challenge is bigger than one individual, one team and one company."

Graf stresses that the sector needs to "really move the needle" from partial security to fully integrated, automated security over time. This, he says, is, inherently, what networks need to deliver – continuous flow of power and security of supply to the country, of which cyber security is one element.

Graf concluded: "Traditionally we have done quite well but now we are really ramping up the curve to get there – advancing a sustainable energy future for all."

Hitachi Energy's core mission is to provide technology and help society with sustainable networks that facilitate the energy transition

Advancing a sustainable energy future for all

We are advancing the world's energy system to be more sustainable, flexible and secure.

As the pioneering technology leader, we collaborate with customers and partners to enable a sustainable energy future – for today's generations and those to come.

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Hitachi Energy

EDF seals GE turbine deal as France refocuses on nuclear

- EDF to buy GE's conventional island equipment for new nuclear power plants
- President Macron plans up to 14 new nuclear plants

Junior Isles

French state-owned utility EDF has signed an exclusive agreement to buy part of GE's steam power nuclear business. The move will support the country's recent decision to build a new fleet of nuclear power plants, as it looks to reduce future dependence on energy imports.

The proposed transaction includes GE Steam Power's conventional island equipment for new nuclear power plants – including the world's most powerful steam turbine in operation, the Arabelle turbine, as well as maintenance and upgrades for existing nuclear power plants. The transaction would also include steam turbine technology for future nuclear plants, like the next generation of European pressurized reactors (EPR2) and small modular reactors (SMRs).

Financial terms of the proposed transaction were not disclosed, though financial daily *Les Echos* said EDF would pay $273 million (€236 million), of which $73 million is assumed debt. The proposed transaction is subject to consultation with employee representatives and other customary closing conditions, including regulatory requirements. The transaction is expected to close during the first half of 2023.

Commenting on the deal, Jean-Bernard Lévy, Chairman and Chief Executive Officer of EDF, said: "The climate emergency is reaffirming the role of nuclear energy. EDF is proud to contribute to the achievement of carbon neutrality by preserving this technology.

"This plan to acquire part of GE Steam Power's nuclear activities including the Arabelle turbine will enable EDF to strengthen its key technologies and skills for the nuclear fleet in operation and for new nuclear projects in France and worldwide."

Buying the turbines would give EDF a key component for the new EPR reactors it hopes to build in France while also wooing international clients looking to reduce reliance on fossil fuels for energy.

The move by EDF is seen as the latest step in President Emmanuel Macron's plans to revive his country's atomic power drive. He insists new nuclear is crucial for supplying zero-emission electricity as Europe moves to slow global warming and reduce its dependence on imported oil and natural gas.

France has not invested in its nuclear industry over the last decade, following the nuclear disaster at the Fukushima Daiichi power plant in Japan in 2011. Now it plans to build up to 14 new reactors to power the country's transition away from fossil fuels.

"What we have to build today, because it's the right moment, is the renaissance of the French nuclear industry… France is choosing its independence and freedom," said Macron. "I want six EPR2s to be built and we will launch studies for the building of eight additional EPR2s," he said, referring to the new-generation reactors being developed by EDF.

"Some nations made radical choices to turn their backs on nuclear," Macron said. "France did not make this choice. But we did not invest because we had doubts."

Levy called President Macron's decision "a turning point for the next three decades" and a moment of "re-foundation".

The French government also said it will inject more than €2 billion into EDF in an effort to restore the state-controlled energy group's finances, which are suffering due to nuclear reactor outages and declines in power production.

EDF, which last month reported a rise in profits and revenues for 2021, faces significant challenges this year. Its electricity production forecasts have dropped to their lowest point in three decades, with five of its 56 nuclear reactors offline as it inspects flaws in pipe weldings.

"EDF is going through a bad financial patch," French Finance Minister Bruno Le Maire told reporters during a call last month. He said it was "vital" to inject fresh funds into the company as it gears up for investments in nuclear reactors and renewable energy projects."

SGRE drags Siemens Energy Q1 results

Solid performance in Siemens Energy's Gas and Power business has been overshadowed by negative development at Siemens Gamesa Renewable Energy (SGRE).

Siemens Gas and Power saw orders grow 14 per cent and although revenue slipped by 3.6 per cent, the business ended Q1 of fiscal 2022 (end December 2021) with a record order backlog of €53.6 billion. Overall, however, Siemens Energy reported a net loss of €240 million as SGRE reported disappointing results.

Between October and December, SGRE reported a net loss of €403 million compared to a €11 million profit in the same period a year ago The company confirmed a grim outlook for the rest of the year, saying it remains "immersed in a very complex market environment", with disruptions and low visibility in the supply chain.

Commenting on the results, Christian Bruch, President and CEO of Siemens Energy AG, said: "The solid performance of Gas and Power shows that we make progress with our transformation. Our measures have started to have an impact, and the results are heading in the right direction. However, the latest profit warning at Siemens Gamesa Renewable Energy is a setback and disappointing for all shareholders. As majority shareholder, we will continue to support SGRE in achieving the turnaround in the onshore business even in a difficult market environment."

The results have seen Siemens Energy make some management changes. The Siemens Energy Supervisory Board appointed Karim Amin as Member of the Executive Board, effective March 1, 2022. He is succeeding Jochen Eickholt who leaves the Siemens Energy Supervisory Board to serve as the new CEO at SGRE.

OGUK rebrands to reflect clean energy interests

OGUK, the leading representative body for the UK's offshore oil and gas industry, is to rebrand as Offshore Energies UK to reflect the interest of its members in hydrogen, carbon capture and storage and offshore wind.

The extension of its scope follows the results of a year-long strategic review that was approved by members in December 2021.

Offshore Energies UK says its members will continue to produce the oil and gas "the UK will still need to support its energy security", as well as jobs and the economy.

These companies are also already involved in some of the most cutting-edge low carbon projects across the country, including HyNet North West, Acorn Hydrogen & CCS, Equinor's Dogger Bank wind farm, West Anglesey Tidal Energy Project, Hywind Scotland, Drax Zero Carbon Humber Projects, OGCI Climate Investments and Net Zero Teesside.

The organisation said in a statement: "Our diverse membership is already actively investing in cutting edge, greener and cleaner technologies which add value to the whole UK economy. Over the last 50 years, the offshore oil and gas sector has contributed over £375 billion to the Exchequer and supported hundreds of thousands of jobs. Our members are now building on their oil and gas heritage to make the UK a global centre of green energy excellence that will help achieve net zero, while powering homes and industries."

Oil and gas majors profit off high commodity prices

Both BP and Shell have reported strong final quarter profits for 2021 as as oil and gas prices surge.

With energy and fuel prices soaring in 2022, BP has had a strong fourth quarter, hitting an Underlying Replacement Cost profit of $4.1 billion compared with $3.3 billion in the third quarter, beating consensus expectations of $3.9 billion. The group's net debt also fell to $30.6 billion, a reduction of $8.6 billion from the end of 2020, and shares in BP are up over 23 per cent year to-date. The positive results have prompted a $4.15 billion share buyback programme, as well as an increased dividend.

Shell said it would increase both its dividend and its share buyback programme after a bumper quarter for the oil and gas group. Shell stepped up the pace of its buyback, committing to purchase $8.5 billion of shares in the first half of 2022, and raised its dividend by 4 per cent for the first quarter of its new financial year.

Shell reported adjusted earnings of $6.4 billion for the final quarter of 2021, as high oil and gas prices boosted earnings last year. It has been a "momentous year" for Shell, Chief Executive Ben van Beurden said. The company reported full-year adjusted earnings of £19.3 billion ($25.8 billion), up from £4.8 billion in 2020.

The results, however, saw the international oil & gas majors come under fire for making huge profits as households struggled with skyrocketing energy prices and the rising cost of fuel at the pump.

Both companies made the announcements just as Ofgem, the UK energy regulator, announced the new energy price cap for consumers, which will see the average costs of household energy bills rise by 54 per cent in April.

Commenting on BP's results, Neil Shah, Director of Research at Edison Group, said: "Despite its impressive financial results, with energy bills forecast to rise by over 50 per cent in April, BP's success could have placed them directly in the firing line of public opinion. The group's profit of $12.8 billion for FY21 are sure to escalate calls in Parliament for the implementation of a windfall tax on energy giants such as BP and Shell (who are on course to make a combined profit of £40 billion this year), with the surplus cash being used to deal with the impending cost of living crisis. While the windfall tax is unlikely to materialise at this point, BP has been investing to prepare for a net zero future, with significant operations in the hydrocarbon, hydrogen and offshore wind sectors."

Greenpeace heavily criticised Shell following its announcement. Greenpeace UK's Head of Climate Kate Blagojevic said: "Our continued dependence on fossil fuels is a goldmine for companies like Shell and a scourge for bill payers and the planet. While Shell is quadrupling its profits off the back of record-high gas prices, millions of households are left with cold homes and astronomic bills."

Greenpeace UK has calculated that a windfall tax on the estimated profits of fossil fuel companies could raise £4 billion in revenues that could be used to help struggling consumers.

Americas

EPC contract for Parker solar project

Buckeye Partners has awarded an engineering, procurement and cosntruction (EPC) contract to Black & Veatch for the 270 MW Project Parker solar park in Fall County, Texas, USA. The proposed plant will consist of over 500 000 solar panels and is scheduled to be operational by early 2023.

COWI wins Empire Wind engineering contract

COWI has won an engineering contract from Empire Offshore Wind, a joint venture between Equinor and BP, for the turnkey design of the wind turbine foundations for the Empire Wind 1 and 2 projects off the coast of Long Island, New York.

The Empire Wind project will use 15 MW wind turbines and is planned to have a generation capacity of over 2 GW. It is expected that the project will play a major role in enabling New York state to reach its goal of 70 per cent renewable energy by 2030.

The project will involve the detailed engineering of 138 foundations with diameters of approximately 9 m and lengths of up to 100 m. The wind turbines will be in water depths ranging for 20-40 m.

Electrolysers for US green hydrogen production

A $50 million contract for electrolysers to be used in green hydrogen production has been awarded by Mitsubishi Power Americas to Norway's HydrogenPro. HyrdogenPro will supply 40 electrolysers. The order depends on a final investment decision on the project, due to be taken in the first half of 2022.

The green hydrogen plant will be powered by wind and solar electricity and will be equipped with Mitsubishi Power's Hydaptive green hydrogen packages. Its output will be stored and used for power generation, transport, and industrial applications in the USA.

SNC Lavalin to inspect Bruce Power

Candu Energy, a member of the SNC-Lavalin Group, has been awarded a 42-month, $22 million contract to perform advanced non-destructive examination (ANDE) and associated maintenance on fuel channels for the Candu heavy water reactors at Bruce Power in Ontario, Canada.

Candu Energy will provide critical inspection and analysis to support the long-term health of the reactor core.

Sandy Taylor, President Nuclear, SNC-Lavalin, said: "Our experienced specialists, technicians, engineers, designers, programmers and software developers align us to execute these types of projects as a one-stop-shop for all reactor inspection and maintenance needs."

Energy storage system for Suriname gold mine

Wärtsilä will supply a 7.8 MW/7.8 MWh energy storage system to a gold mining company in Suriname. This is the first utility-scale energy storage system to be built in Suriname and Wärtsilä's first energy storage project in the country. The order was booked to Wärtsilä order intake in Q4, 2021. The facility is expected to become operational in late 2022.

The integrated energy storage system will reduce the need for emergency back-up spinning reserve, therefore lowering fuel consumption. The project is estimated to reduce the mine's emissions by 5600 tonnes of CO_2 equivalent per year.

The facility will include Wärtsilä's GridSolv Quantum energy storage system and the GEMS Digital Energy Platform, Wärtsilä's energy management system. GEMS will control and optimise the portfolio of both the existing generating sets and the new energy storage system

Asia-Pacific

Vietnamese combined cycle order for Samsung

PetroVietnam has awarded a $510 million contract to Samsung C&T to construct a combined cycle power plant in Vietnam. This includes the construction of Nhon Trach 3 and 4 combined cycle power plants with a total 1.6 GW capacity at Ong Keo industrial complex.

Under the terms of the contract, Samsung will form a consortium with Lilama to build gas and steam turbines, HRSGs, substations, and power transmission lines for the plants.

Siemens to supply HL gas turbine to South Korea

Siemens Energy has won an order to supply an HL-class gas turbine for the Eumseong Unit 1 combined cycle power plant (CCPP) in northwestern Chungcheongbuk-do Province, South Korea. The plant will be built instead of a 1000 MW coal fired plant cancelled as a result of a change in South Korea's environmental policy.

The client is Korea East-West Power Co, Ltd, a subsidiary of South Korea's state-owned utility Korea Electric Power Corp. (Kepco). The new plant is scheduled to be commissioned in late 2024.

Eumseong 1 is the first of two planned CCPP units and will have an installed electrical capacity of 571 MW. The power plant is designed as a single-shaft unit that will operate on LNG. Siemens Energy's scope of supply includes a SGT6-9000HL gas turbine, SST-5000 steam turbine, SGen-3000W generator, and SPPA-T3000 control system.

The order also includes a long-term management contract for the gas turbine.

MingYang 11 MW units for offshore China

Guangdong Electric Power Development has awarded a contract to MingYang Smart Energy, under which the wind turbine manufacturer will supply its MySE 11-230 typhoon-proof hybrid-drive turbines for a 1 GW offshore wind project.

The project, located in deep waters offshore Guangdong province, comprises two phases: 600 MW Qingzhou 1 and 400 MW Qingzhou 2. The two projects are valued at an estimated €2.4 billion.

The two wind farms are scheduled to be fully commissioned in 2023 and will together supply 3.6 TWh annually.

Europe

Van Oord picks Sofia inter-array cable supplier

Hellenic Cables has won a contract from Van Oord Offshore Wind UK to supply 66 kV inter-array cables and accessories for the 1.4 GW Sofia offshore wind project in the UK.

Under the terms of the contracts, Hellenic Cables will design, engineer, manufacture, test and supply approximately 360 km of 66 kV XLPE-insulated inter-array cables and associated accessories.

The cables will be manufactured at the company's submarine cable production plant in Corinth, Greece. Production is expected to begin this year and to be completed in 2023.

RWE's Sofia offshore wind project is located on the Dogger Bank in the North Sea, 195 km from the UK northeast coast. The wind farm will feature 100 SG 14-222 DD turbines scheduled to be fully commissioned in 2026. Offshore construction is expected to start in 2023.

Acciona to build WtE facility in UK

Acciona has signed a £683 million contract with the North London Waste Authority to design and build a waste-to-energy (WtE) power plant in Edmonton, UK.

The proposed energy recovery facility (ERF) forms part of the £1.2 billion North London Heat and Power Scheme which will serve seven north London boroughs. The first phase of the ERF will be funded via a £280 million loan from the Public Works Loan Board.

Deutsche Windtechnik to service Polish wind farm

The Polish subsidiary of Deutsche Windtechnik has signed a 15-year contract to provide full-services to the Ścieki wind farm in central Poland, owned by Green Investment Group (GIG). There are 11 Vestas V90 wind turbines at the wind farm.

The scope of the service contract includes full service including major components and guaranteed energy-based availability of the wind turbines. To support the ability to carry out the service contracts effectively, Deutsche Windtechnik has opened new service stations in central Poland. In addition, the Polish unit of Deutsche Windtechnik has expanded its operational service team in the region.

BeGreen orders 328 MW of solar power

Danish solar developer BeGreen has signed an agreement with the INTEC Energy Solutions (INTEC) and Chint Solar (Chint) partnership for construction of one of northern Europe's largest solar power plant portfolios.

The 328 MW Brilliant portfolio comprises three large-scale solar power plants at Barmosen (137.3 MW), Bregentved (111.7 MW), Vildbjerg (66.7 MW), and additional expansion of 13 MW, to be constructed as turnkey projects.

Doosan Heavy I&C wins WtE order

Doosan Heavy I&C has won a $134 million order to build a waste-to-energy (WtE) plant in Germany. Its German subsidiary Doosan Lentjes recently received the notice to proceed from MHKW Wiesbaden for the project in Wiesbaden, Germany.

Doosan aims to complete the construction by 2024 on an EPC basis. The plant will be capable of processing 600 tons of municipal waste per day to provide 22 MW of electricity and 40 MW of heat.

Park Hong-wook, Head of Power Service BG at Doosan Heavy I&C said: "In line with the strengthening rule for waste management in Europe, related markets are growing fast with new orders for an average 10 units of WtE facilities placed annually for the past five years. We'll keep up efforts to target the European market, with new orders for an estimated 80 units of WtE facilities by 2025."

International

Andritz to modernise Jebba unit 2

An order to modernise the second generating unit at Jebba hydroelectric power plant on the Niger River has been awarded to Andritz by Mainstream Energy. This follows an order to modernise the first unit in January 2021. Commissioning is scheduled for the start of 2024.

The Andritz scope of supply and services comprises the entire electro-mechanical and hydro-mechanical equipment, including a 96.4 MW turbine, a 103 MVA generator and accessory equipment, as well as the intake gate.

The general rehabilitation programme will extend the equipment service life for 40 years, improve reliability, and ensure compliance of the frequency and voltage control with the national grid code.

The Jebba hydropower plant is located in the North Central zone of Nigeria, about 100 km downstream of the Kainji Hydroelectric Power Plant. It is equipped with six 96.4 MW turbines with a total generating capacity of 578.4 MW.

SEC launches tender for transmission line project

Saudi Electricity Company (SEC) has launched a tender for the installation of a 380 kV double circuit overhead transmission line (OHTL) in Saudi Arabia. The scope of work includes the design and construction of a 380 kV 165 km OHTL from the Taiba Power Plant to various SEC's substations.

The selected contractor will deliver the project on a turnkey basis, being responsible for the design, engineering, materials procurement, installation, construction, testing and commissioning of the substations. The deadline for submission of bids is March 10, 2022.

Vertex solar modules for the Middle East

Trina Solar has signed a deal with Al-Rabei to supply N-type Vertex solar modules for distribution in the Middle East. Trina Solar aims to supply the Middle East market with 40 MW N-type Vertex solar modules.

The 210 mm Vertex portfolio of modules ranging from 400W+ up to 690W+ are designed for residential, C&I and Utility Sector use.

Antonio Jimenez, Managing Director and Vice President, Middle East, Trina Solar said: "We are proud to see more solar projects in the Middle East implemented through our authorised distributor Al Raebi and play a key role in the already large photovoltaic industry in the Middle East."

Sumitomo secures UAE HVDC cable contract

Sumitomo Electric Industries has received a limited notice to proceed (LNTP) from Samsung C&T to deliver a submarine HVDC cable for Abu Dhabi National Oil Company (ADNOC) in the United Arab Emirates (UAE). This will use Sumitomo's 400 kV DC Cross-Linked Polyethylene (XPLE) cable technology.

The project value is approximately $200 million and system operation is expected to be started in 2025.

This is part of the Project Lightning, a new submarine HVDC network for the Abu Dhabi National Oil Company (ADNOC).

Hydrogen

Hydrogen to impact LA's energy future, as US, India and Saudi Arabia make further hydrogen plans

- SoCal to develop largest green hydrogen network in US
- Neom could make Saudi Arabia world's largest producer of green hydrogen

Gary Lakes

Southern California Gas Company, the largest gas utility in the US, announced in mid-February its intention to develop the country's largest green hydrogen network, which it calls the 'Angeles Link'. SoCalGas, a division of Sempra Energy, has applied to build a 10-20 GW electrolyser and 25-35 GW of new wind and solar power generation systems to serve the Los Angeles area. The plan would include 2 GW of energy storage, plus a new pipeline to transport the hydrogen from areas with large renewable energy potential.

The project is designed to deliver some 25 per cent in the equivalent in hydrogen as SoCalGas currently supplies in natural gas to some 22 million homes in southern California. Green hydrogen is produced from water using electrolysis and is about four times the cost of producing hydrogen using natural gas. However, the goal in the US is to bring down the cost of green hydrogen to $1.00-1.50/kg by the end of this decade.

Meanwhile, the US Department of Energy last month invited proposals regarding the creation of clean energy hubs throughout the country. The Biden Administration plans to invest some $8 billion in hydrogen projects that would put the US on a net zero footing for the middle of the century. Much attention is to be focused on decarbonising the industrial sector, which accounts for a third of greenhouse gas emissions.

The government also plans to put $1 billion into a clean hydrogen electrolysis programme that would produce hydrogen from clean and renewable sources. A further $500 million will go to research and development for hydrogen production and recycling.

"We know that clean hydrogen can reduce emissions in many sectors of the economy, especially in heavy industries like steel manufacturing and fertilizer production," a DoE official said. The infrastructure law specifies that the hubs must support different types of hydrogen production including from nuclear, fossil fuels, and renewable energy. Using fossil fuels for hydrogen production is a contentious issue amongst environmentalist who argue that doing so will only prolong the use of hydrocarbons.

The Administration will issue formal applications for funding for projects once they receive the requests for information about projects from companies, environmental groups and others. That will help determine the location of the hubs, which will distribute hydrogen for transport, industry, power generation and heating.

In Asia, India's Reliance Industries announced that it will invest millions of dollars in producing blue hydrogen – which is produced by using natural gas – at its petroleum coke plant in Jamnagar. Reliance said its investment will make it the largest producer of blue hydrogen in India and that demand for hydrogen will lead to it producing green hydrogen in the future.

The Jamnagar plant currently produces syngas, which will be used to produce blue hydrogen at a targeted price of $1.20-1.50/kg. Blue hydrogen production is supposed to be carried out in conjunction with carbon capture and storage (CCS), a technology that has yet to be proved commercially viable and environmentally sound. Blue hydrogen is produced by splitting the methane molecule in natural gas and sequestering the carbon.

Reliance has expressed its intent to invest $79 billion in green energy projects that will drive decarbonisation in India. This includes 100 GW of renewable energy power plants. The group has set 2035 as its target for net zero emissions and believes it can produce green hydrogen for $1/kg by 2030.

Saudi Arabia has unveiled plans to become a major producer of green hydrogen with a 650 000 ton capacity plant being readied for construction at the new – yet to be constructed – city of Neom on the northeastern coast of the Red Sea.

If the plant reaches its target capacity, it will make Saudi Arabia the world's largest producer of green hydrogen. Construction is due to begin in 2026. While the country remains committed to its giant oil and gas industry, it recognises that the shift to renewable energy is inevitable under the threat of global warming.

The Neom green hydrogen plant is a 2020 joint venture between the US company Air Products, Saudi ACWA Power and the Neom Company. Most of the funding is expected to come from Saudi Arabia's Public Investment Fund (PIF), the country's $500 billion sovereign wealth fund.

Plans are also afoot to create a hydrogen plant built for export, most likely in the form of ammonia. Saudi Arabia has already exported one cargo of ammonia to Japan in September 2020.

Gas

Europe confronts prospect of losing Russian gas supplies

Now that the EU has introduced "hard hitting" economic sanctions against Moscow, it will be forced to move fast to ensure that it can meet its natural gas needs without increasing its reliance on Russia.

Gary Lakes

Europe has long been dependent on Russia for up to 40 per cent of its natural gas supplies – a fact that the European Union has been aware of for a considerable time. Well before Russia's army invaded Ukraine, the EU was making plans to reduce its dependence on Russian gas imports.

Russia has twice before halted supplies through Ukraine for brief periods prompted by disputes with Kyiv over prices: once in 2006 and again in the winter of 2008-09. Both times set alarm bells ringing in the EU. Convinced by those incidents that Moscow was prepared to use its energy exports for political leverage, the EU embarked on a series of Brussels-based projects, including LNG import terminals and interconnecting pipelines designed to assure that EU members had reliable access to natural gas from neighbouring EU members to cover any shortfall and provide 'energy security,' a term that has come to represent the organisation's collective energy policy.

Oil and gas prices rose sharply with the start of the Russian invasion. Bloomberg reported that benchmark Dutch gas rose by 62 per cent on February 24 and the cost for power in Germany increased by 58 per cent. The news agency quoted an analyst at UBS Group AG as saying: "In the extreme risk case, which we would define as one that has a lasting and material negative impact on global growth, the conflict could escalate to a level that pushes Western nations to accept a disruption on Russia's energy flow."

Now that the EU has introduced "hard hitting" economic sanctions against Moscow, including the withdrawal by the German government of the application for certification of the Nord Stream 2 pipeline, Europe will be forced to move fast to ensure that it can meet its natural gas needs without increasing its reliance on Russian gas. While imports of Russian gas to Europe will not stop for now, the evolution of the conflict may bring further complications.

With it becoming increasingly clear that Moscow was not likely to negotiate over Ukraine, Western leaders met in mid-February at the Munich Security Conference where European Commission President Ursula von der Leyen reassured the international participants that the EU would survive the winter despite having Russia "deliberately" reduce gas supplies. The EU had already taken steps to diversify gas supplies, she said.

Since October, Russia had reduced gas exports to Europe, resulting in gas stocks in the EU falling to around 47 per cent, according to Commerzbank.

"Even in case of full disruption of gas supply from Russia," Von der Leyen said, "we are on the safe side for this winter. For the time being we would be able to replace the Russian gas with LNG deliveries that we get from our friends all over the world. A strong European Union cannot be so reliant on an energy supplier that threatens to start a war on our continent," she added.

With the course of the invasion and its aftermath a huge question, Europe will now have to take steps to ensure itself of an energy future in which Russia plays a minimal role. Von der Leyen urged European countries to step up effects to speed up the transition to sustainable energy sources.

"We must diversify both our suppliers and our energy sources," she said, adding that the EU is "doubling down" on renewables. "This will increase Europe's strategic independence for energy," she said.

Ukraine itself stopped buying Russian gas in 2015 after the 2014 Maidan Revolution (although Russian gas still flows through Ukraine) and relies on reverse-flow pipelines to import gas from EU members. Ukraine once transported some 140 bcm/year of Russian gas to Europe. The volume currently is around 42 bcm annually.

Much discussion has taken place in recent weeks about where Europe may find new gas supplies if those from Russia should stop. The US has interceded with Japan regarding shipments of LNG to Europe. Qatar, the LNG giant producer, has been approached to boost exports to the EU, and Australia is also expected to contribute to any shortfall.

The crisis has prompted US LNG producers to push ahead with LNG export plans, although Europe may be pressed to build more gas storage. Meanwhile, Norway is supplying Europe with gas at maximum capacity. It is the EU's second-largest supplier. There are minimal volumes of gas that comes from Azerbaijan (10 bcm/year) through the Southern Gas Conveyor.

Future gas import possibilities for Europe lie with Egypt and the East Mediterranean, although Israel and Cyprus have yet to develop their gas resources sufficiently. Israel is exporting to Egypt, where Israeli gas can be processed into LNG. The case will be the same for Cyprus at some point when the island's resources come on line.

Power-to-X and green fuels: Fruit from the 'decision tree'

Power-to-X and green fuels can be the key to decarbonisation but much remains to be done in order to create more viable business cases, says MAN Energy Solutions' **Florian Gruschwitz.**

There is no doubt that green hydrogen is a key element on the path to decarbonisation. Nor is there even the least surprise these days that green hydrogen – and Power-to-X in general – has gained so much popularity and public attention. For good reason, this will not be a flash in the pan.

Strong drivers like the EU's 'Fit-for-55' programme underline the reality that decarbonisation has now become a serious target and many countries have already published ambitious hydrogen strategies. Companies like MAN Energy Solutions can already provide the necessary, key technologies along the Power-to-X and green hydrogen value chain and have serious skin in the game through significant investments aimed at further extending the base of necessary technologies.

Mature technologies, for instance for eFuel production, are available that enable the use of existing infrastructure, but much remains to be done in order to create more viable business cases. It can be shown how derivative fuels, or eFuels, can successfully complement green hydrogen in its elemental form and be an important enabler in the ramp-up to a green hydrogen economy.

One thing is clear: elemental green hydrogen will not be a one-size-fits-all solution. Instead, we will have a multi-option scenario where pragmatic approaches will aim at maximum efficiency, whilst at the same time ensuring that a solid base and ramp-up path for long-term transition to green hydrogen is created.

To get the full picture, it is helpful to look at the topic from two perspectives: firstly, viewing Power-to-X in the context of how it can play an important role in reaching decarbonisation targets; and, secondly, looking at the main hurdles – but also success criteria – in getting a green hydrogen economy ramped up at a global level.

If we agree that decarbonisation is an underlying imperative in order to save the planet, then a policy comprising four elements can be identified, beginning with replacing fossil-fuelled power generation with renewable energy sources. The use of green hydrogen and employing eFuels (based on green hydrogen) are two further elements. And the fourth – for the hard-to-abate carbon sources – is carbon capture and storage technologies, again combined with Power-to-X technologies.

These four elements may be viewed as a type of 'decision tree' such that, when addressing an application that acts as a considerable carbon source today, all four means of decarbonisation need to be assessed in the order shown to find the 'best fit' – i.e., the most effective way to achieve decarbonisation considering all current, boundary conditions.

Needless to say, decarbonisation is reliant upon an abundant availability of renewable energy. Accordingly, extending the capacity of renewable energy generation is of paramount importance. The first question in our quest for decarbonisation is then: is direct electrification possible? This means, first of all, replacing all fossil-fuelled power generation with renewable energy. However, natural gas fuelled power plants, for example, may be tolerated as 'back-up' or 'peakers' as they facilitate the maximum use of renewable energy in the grid while simultaneously ensuring maximum reliability and grid stability.

Besides electrical energy, heat generation is another of the largest contributors to carbon emissions. In this respect, heat pumps will undoubtedly become a big success. These could cover the demand for heating buildings but it is no secret that heat-demanding industrial processes are another large contributor to carbon emissions. In many cases, direct electrification with heat pumps powered by renewable energy could be an optimal solution. Large-scale heat pumps that can achieve temperatures rising to hundreds of degrees Celsius are already available in the market.

Continuing through the 'decision tree', for applications that cannot be directly electrified as of yet or even in the longer term, the use of green hydrogen could be a good option and many examples exist. However, following the Pareto principle, some prominent areas especially suited for decarbonisation can be identified, such as steel production where production with green hydrogen instead of coal would cut carbon emissions considerably.

Another good example of a sector ripe for decarbonisation with green hydrogen, is within processes that already require large amounts of hydrogen today. Here, 'grey' hydrogen is currently used and produced by steam reformation with natural gas. One such example is fertilizer production where ammonia as a main feedstock requires large amounts of hydrogen.

This leads us to the third stage in the 'decision tree', when neither direct electrification nor the use of elemental green hydrogen is possible. In such instances, eFuels may be a solution. Derivative fuels or eFuels in this context are carbon-neutral fuels based on green hydrogen. This includes synthetic methane, methanol or 'e-Kerosene' – or ammonia produced from green instead of grey hydrogen, which provides a carbon-free option.

As such, derivative fuels could play an extremely important role: acting as a bridge technology and replacing their fossil twin, leading to carbon-neutrality; as a carrier medium for green hydrogen; or even as 'green' feedstock as for the prior-mentioned 'green' ammonia for fertilizer production. One of the great advantages in derivative fuels is their direct applicability today!

But even if we picture a fully electrified, green hydrogen and eFuel-powered world, we must not forget that there are still applications or processes that intrinsically emit larger amounts of carbon. One very prominent example is cement production where, during the calcination process, large amounts of CO_2 chemically bound within limestone are released. Pilot projects have already demonstrated, in order to reach the targeted 'net zero' for atmospheric emissions, that these carbon emissions can be captured, liquefied and stored in subsea locations. Another method of reaching 'net zero' would be to use this CO_2 to produce methanol as a chemical feedstock. In this way, carbon can be bound again as part of a circular economy.

In conclusion, a carbon-neutral world – the desired "net zero" – to avoid further climate change is within reach and without having to completely change the world, the products we use, nor our way of life. We can also see that green hydrogen and Power-to-X are key elements in this transition. The question then is: how do we ramp up the green hydrogen economy? For this, we will have to consider the whole value chain: the production of green hydrogen and derivatives, its transport to its application, and of course the application itself where – as in the case of direct reduction ovens for 'green steel' production – some considerable investments will be needed.

Accordingly, all parts of the value chain need to be pushed and ramped up simultaneously. Large, industry wide programmes like Germany's 'H2.Giga' initiative are helping to scale up electrolysis to industrial levels with accompanying cost-reductions. However, the cost reduction of green hydrogen production alone does not make for a feasible business case when green fuels have to compete with their fossil twin without integrating the external cost of additional carbon introduced to the atmosphere. Thus, respective carbon taxation is needed as well as – at least for the ramp-up phase – smart 'Carbon Contracts for Difference' schemes like the German 'H2.Global', to finally make larger Power-to-X projects bankable.

Setting up a global hydrogen economy is necessary to leverage renewable energy potential in regions where it cannot be otherwise used and in order to not cannibalise renewable energy capacities in regions with high demand. This would also help to bring sustainable prosperity to more parts of the world and could solve strong global (inter) dependencies in energy trading.

Large-scale off-takers such as steel production have to be created – for example, in line with EU IPCEI projects. Even if they had to rely on 'blue' hydrogen in a starting phase, this means that investments could be made and hydrogen pipeline infrastructures created. Subsequently, as soon as green hydrogen production was at scale, a 'switch' to green hydrogen would be possible with all the major investments made up to that point in time. As such, it's acceptable for many of the first, large Power-to-X projects to rely on derivative fuels since ocean transport of elemental hydrogen is a challenge. eFuels can complement a green hydrogen economy, are an enabler for larger electrolyser plant setups, and can resolve the chicken or egg dilemma until hydrogen grids become available to provide inexpensive transport, storage and distribution options.

Seen from an industry perspective, we can say that we are ready and eager to shape the future. We are taking the risk and investing in the transformation of our portfolios and to provide the necessary technologies. Now we need the necessary political action in order to ramp up a global green hydrogen economy and to convert decarbonisation targets into reality.

Florian Gruschwitz is a Senior Manager working in Business Development New Energies at MAN Energy Solutions.

Gruschwitz: all parts of the value chain need to be pushed and ramped up simultaneously

On the road to mass e-mobility

We are on the road to mass e-mobility, and there is no turning back. A joint report between Eurelectric and EY reveals the transition to e-mobility is gaining pace but Eurelectric's **Kristian Ruby** asks how do we sustain this trend?

The journey to e-mobility has felt like a long and winding road since the development of electric vehicles in the 1800s. But our destination is finally within reach. Last year, in Europe, EV market share doubled to 20 per cent – up from 10 per cent in 2020. As recently as December last year, sales of battery electric vehicles across western Europe overtook diesel models for the first time. We have crossed into the era of e-mobility, where EV uptake has gone from glacial pace to lightning speed.

The age of the internal combustion engine, or ICE Age, could soon be consigned to the history books.

Today, the EV share represents just 1 per cent of Europe's total 326 million vehicle parc. However, change is coming, and it is coming fast. By 2030, there will be 65 million EVs on the roads of Europe. Five years later, that figure will have doubled to 130 million, almost 40 per cent of the 323 million ICE vehicles currently on our roads. These statistics and more are detailed in our new report with EY, entitled 'Power sector accelerating e-mobility: Can utilities turn EVs into a grid asset?'

Now that the transition to e-mobility is gaining pace, the question is – how do we sustain this trend?

There is no doubt that government incentives, such as subsidies and tax rebates to individuals and corporations, are helping flick the switch to EVs in the European market. In some countries, new incentive schemes have also been introduced to bolster the short-term recovery of the automotive industry from the impacts of the pandemic, further fuelling EV sales. To date, 20 European countries offer incentives such as bonus payments or premiums, cutting the price tag of the average electric car by as much as €12 000.

A clear target for CO_2 reductions between 2025 and 2035 should be established to give industry the necessary clarity. Regulation should also foresee some more stringent cuts on air pollutant emissions but also CO_2 targets for heavy-duty vehicles, and objectives for the uptake of zero-emission vehicles in corporate and urban fleets.

For consumers and automakers alike, there are significant benefits to a growing EV market. Buyers have witnessed electric cars accelerate towards the affordability tipping point, with a narrowing price gap between EVs and petrol/diesel models. In fact, it is predicted that this gap will close by the middle of this decade. For the car manufacturer, meanwhile, the cost of battery packs has plummeted without impacting either the efficiency or the range of vehicles. Indeed, several automakers have unveiled models capable of driving 800 km on a single charge.

With all this great EV power, however, comes great responsibility. The 130 million EVs projected for Europe by 2035 will require at least 65 million chargers – nine million of which will be public and 56 million residential – to keep them motoring along. This equates to approximately 180 times the number of chargers installed across Europe at the present time.

Last year, the European network of public chargers grew by 40 per cent – this is fast, but not fast enough. Market forces will not be sufficient to deliver the pace and type of EV charging infrastructure that is required for the road ahead. Forward-looking regulatory frameworks that enable roll-out are a must.

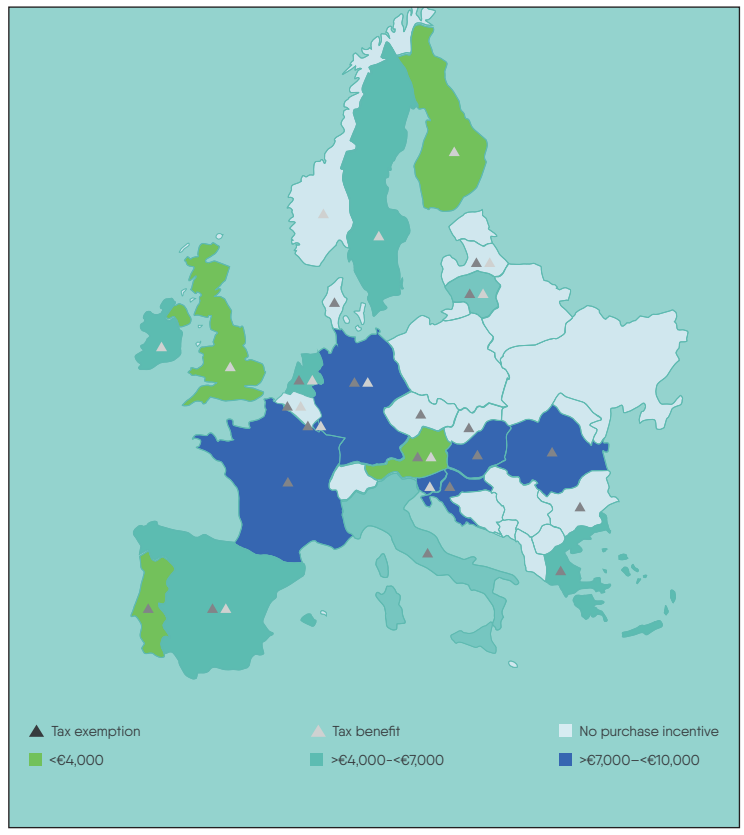
This includes a higher ambition than that of the current Alternative Fuels Infrastructure Regulation (AFIR) proposal, which is needed to kickstart national investment in the charging network and bring it to where it needs to be for mass EV adoption.

Our study reveals that 85 per cent of charging will be done at home, 6 per cent in the workplace, 5 per cent at the destination (semi-public charging in commercial sites), and 4 per cent on highway corridors. As a result, different types of chargers will have to be installed in each location to guarantee a seamless charging experience for drivers.

The roll-out of charging infrastructure in a timely manner is therefore crucial. Preparation is essential, and the bottlenecks already being experienced in Europe will need to be addressed. Today, charge point operators report months'-long delays in getting permissions from local authorities to install public infrastructure, while connecting chargers to the grid can take anything from two months to three years.

Under the recently revised Energy Performance of Buildings Directive (EPBD), new and renovated buildings across Europe will have to be equipped with charging points or be fitted with the infrastructure to install them. But requirements for existing buildings are too weak, meaning that the "right to plug" will remain out of reach for many Europeans.

In addition, there has also been some uncertainty as to who pays for grid connection – for instance, should the responsibility fall to a residential or commercial tenant, or their landlord? This lack of clarity makes an already-complicated situation even more complex.



EV incentives across Europe

Poor interoperability between charger networks, meanwhile, is predominantly due to a lack of standards. The upshot, however, is that it restricts user choice about where and how to pay. This, combined with less-than-satisfactory reliability on some networks and varying levels of customer service, has also proven to be a concern.

As for the grid, our report determines that yes, it will by and large be able to cope with the additional charging demands that 2035 will bring. A managed approach to charging is, however, needed.

The study points out that any unpredictable fluctuations in demand driven by a significant number of EV drivers charging simultaneously could potentially destabilise the grid in the long run.

More than a third of Europe's grids are already over 40 years old, and by the end of this decade, that share will have reached 50 per cent. By 2030, it is estimated that between €375 billion and €425 billion will need to be invested in distribution grids, with 8 per cent targeted at e-mobility and integration of EV charging infrastructure. The bulk of the spending is triggered by modernising the distribution grid to electrify buildings and industry and integrating decentralised sources of generation.

We cannot deny that the challenges we face over the coming years are significant. Thankfully, electricity utilities, charge point operators (CPOs), grid operators, automakers, local authorities, and other stakeholders are already looking at potential solutions.

For instance, distribution system operators (DSOs) will be a critical cog in EV expansion, putting vehicles on the road while keeping the lights on. However, if they are to successfully match chargers to user needs and increase facilities, DSOs – responsible for planning grid development, managing distribution grids, billing, and connecting chargers – will have to analyse EVs driver-usage patterns and locations before e-mobility really speeds up.

Fortunately, smart grid technologies such as smart meters, can increase monitoring capabilities and therefore contribute to a more accurate understanding of where grid modernisation investments are needed, or can be avoided.

Another vital resource will be smart charging – this will enable EV charging to be intelligently controlled. In the future, smart charging should be the norm as part of a driver's "right to plug", allowing EVs to be charged when green energy is cheapest and at its most plentiful.

In time, as smart-charging technologies become more sophisticated, vehicle-to-grid (V2G) solutions will allow power stored in EVs to be pushed back to the grid or to a home, office, or factory, to balance energy production and consumption. EVs engaged in V2G will help boost the efficiency, reliability, and stability of the grid through flexibility services such as load balancing, peak shaving, and by providing support for the incorporation of renewable energy.

The journey towards our EV future is well underway. To reach our destination safely – and on time – we will, between now and 2035, have to rely on the aforementioned ecosystem of DSOs, CPOs, network companies, planners, and local authorities. Timely planning and coordination, as well as the deployment of smart technologies for metering and charging will be crucial to continuously accelerating this evolution.

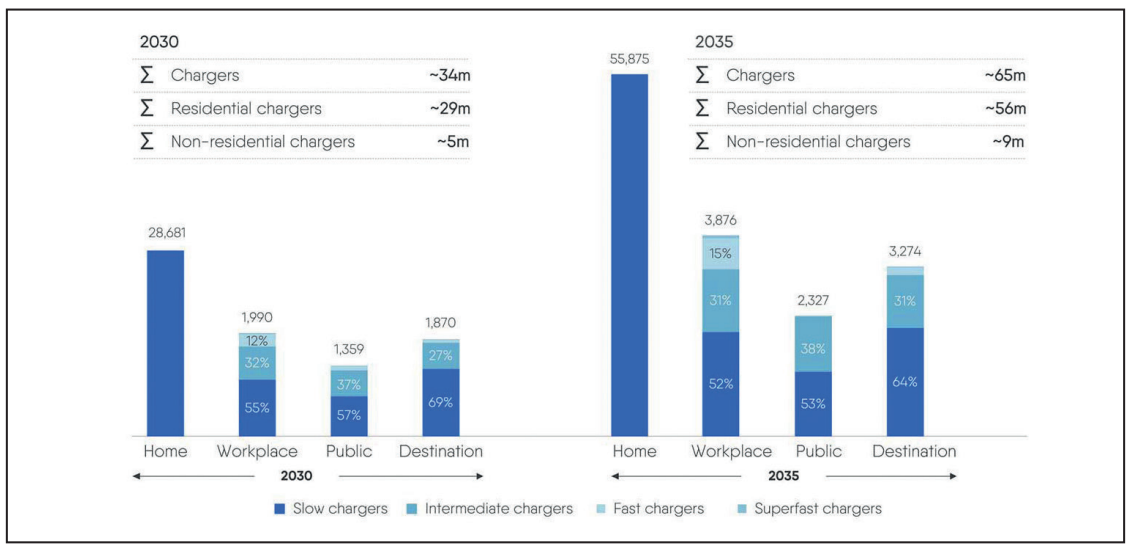
In addition, grid renewal, increased interoperability, the simplification of overly bureaucratic authorisation procedures, and the development of flexible charge points are just a few more of the issues they will have to address to ensure a smooth and pleasant journey for all of us.

We have finally found ourselves on the road to mass e-mobility, and one thing is certain: whatever challenges lie ahead, there is no turning back

Kristian Ruby is Eurelectric's Secretary General.

Ruby: our report determines that the grid will, by and large, be able to cope

Necessary charging stock by location and type



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Give and take: the data centres balancing the grid

Data centres use around 1 per cent of the world's electricity every year – an estimated 200-250 TWh, according to the International Energy Agency. But now with advances in technology, a data centre's relationship with the power network does not have to be one way, as new uninterruptible power supply designs can offer the opportunity to give something back in the form of demand-side response services. ABB's **Elina Hermunen** explains.

Finland is one of the world's most connected countries. It has been considered a legal right for residents and businesses to have broadband internet access since 2010 and currently 96 per cent of households have access to broadband. This is expected to reach nearly 97 per cent by 2026.

While Nordic data centres are growing rapidly, Finland has a unique challenge in keeping the power flowing to its country's data centres as it is also one of the world leaders in the utilisation of renewable energy sources. This represents about 40 per cent of its energy-end consumption, and in the next decade, the Finnish government hopes to raise this to more than 50 per cent.

With more variable renewable energy generation on Finland's power grid (which is operated by Fingrid), the need for third-party balancing services is essential to maintaining voltage and frequency levels. Rather than just taking power out of the network, Finland's data centres can now deliver frequency regulation services back to the grid, which helps in turn to keep their own power supply stable.

In Finland's capital city Helsinki, the telecommunications company Telia recently installed groundbreaking new uninterruptible power supply (UPS) equipment from ABB at its data centre as part of an agreement with the leading national energy company Fortum, to provide balancing services that will help Fingrid provide continuous power across the country. Opened in 2018, Telia's 34 000 m², 24 MW Helsinki data centre is one of the largest in Finland.

UPS equipment supplies electrical energy when the grid supply fails, while eliminating brownouts, overvoltages, electrical noise, frequency variations or harmonics by cleaning and improving the incoming waveform. A critical part of any UPS is the energy storage capacity, which stores energy in case the primary source fails. Most of the time, these capital-intensive energy storage systems lie unused, or store more energy than is needed. However, with frequency regulation functionality (FRF)-enabled UPS equipment, it can play a more active role in supporting data centre operation and the power grid it is connected to.

The new FRF-enabled UPS systems from ABB installed at Telia's Helsinki data centre are participating in Fortum Spring – a "virtual battery" scheme operated by Fortum, which can call on this distributed energy infrastructure when needed to compensate for potential shortfalls in energy generation or to cover unexpected peaks in demand.

The Fortum Spring virtual battery has access to output from the batteries in the Telia UPS and can feed that power into Fingrid's Fast Frequency Reserve (FFR) market if and when required. The UPS batteries retain sufficient power to cover the data centre against any power outage or other exceptional situation, at which point they are designed to keep the data centre running for a matter of minutes, before the UPS diesel generators switch on. So, there is no risk to the data centre's uptime.

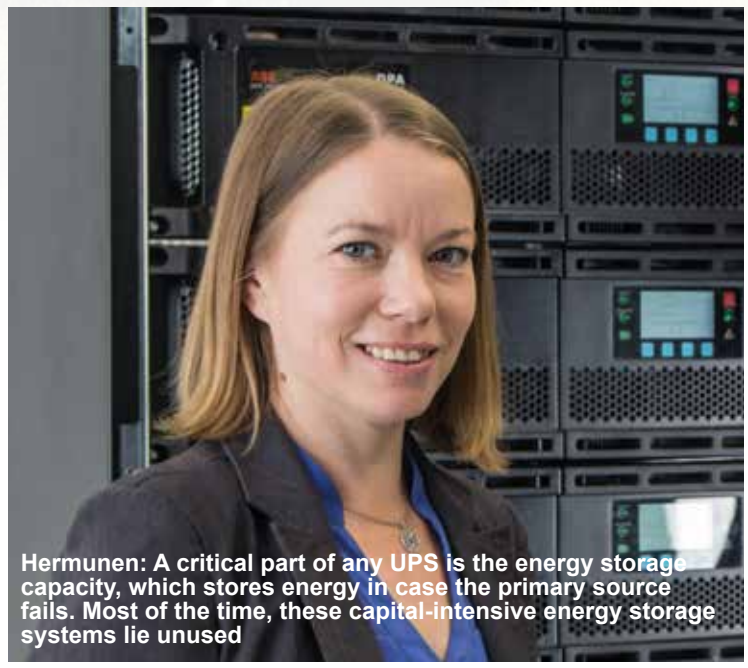
Data centre operators like Telia are very keen to reduce their impact on the environment and play an active part in the energy system. In 2019, the Helsinki data centre (HDC) was awarded LEED Gold certification, recognising the green credentials of the building, and later this year the facility is due to connect to a local district heating scheme.

Telia's development manager Harri Vilonen said: "Utilising HDC's UPS equipment in the electricity market is an important part of a modern data centre and the mitigation of environmental impacts. By participating in the reserve market, we can promote more renewable energy by providing support to the power grid."

Projects like the Fortum Spring virtual battery allow renewables to play an increasingly large part in the electricity mix of Finland, helping to replace the country's fossil fuel-generated capacity with more renewable energy generation like wind, solar and hydro.

Finland currently has a strong baseline capacity, with some 27 per cent coming from nuclear, and 20 per cent from hydro, but the country still gets around 10 per cent of its energy from burning fossil fuels (oil, coal, and gas) and peat, with another 12 per cent from wood burning. To increase the amount of power coming from intermittent renewable energy sources means short-term sources of power are essential to balance production and consumption.

UPS systems and their batteries are ideal to meet this demand as they offer very quick regulating power, and they are an ideal fit for the power reserve maintained by Fingrid. Power can be drawn from the batteries in milliseconds without any delays. If a major disruption occurs in the balancing of the grid, Telia's UPS equipment can respond within a few hundred milliseconds and help in the grid's recovery from the disruption.



Hermunen: A critical part of any UPS is the energy storage capacity, which stores energy in case the primary source fails. Most of the time, these capital-intensive energy storage systems lie unused

ABB has a range of electrification products for data centres and, to support the transition to a renewable future, has recently added UPS with FRF capabilities to its portfolio. While many data centres like Telia operate using a low voltage (LV) power input, the increasing size of data centres means that some are now moving up to a MV intake – so the company offers UPS with FRF to accommodate both.

It is important to remember that when using a FRF product, the data centre is always in control of the battery capacity value parameters so critical loads will always be protected. Minimum and maximum states of charge are set for each mode of operation with dynamic management. Essentially, the utility provider can't take more battery capacity than the operator agrees.

As well as giving power to the grid to help maintain frequency, ABB's FRF can – on request – work the other way around and inject power back to the grid (backfeed) to meet peaks in demand. This is all done using the dynamic management function, although we must add that to activate this function, operators must ensure they are compliant with their national grid codes, standards and requirements defined by local grid operators, utilities, and aggregators.

To make the FRF technology run at its best, ABB designed its UPS with new advanced battery solutions for higher cycling, a longer lifetime and each comes with a dedicated battery management system (BMS) included as standard. The way FRF operates means batteries will be cycled more than usual, which could place more stress on them. Customers are therefore advised to ensure they have a maintenance agreement in place to regularly check battery health for peace of mind that their UPS will perform as expected when needed. ABB's LV UPS FRF products are compatible with its DPA 500, MegaFlex DPA, HiPerGuard MV UPS to make upgrades seamless for those with existing ABB equipment installed.

With next generation UPS equipment, data centre operators like Telia can unlock the capabilities of their on-site energy storage systems and become a consumer and a prosumer, working in partnership with their electricity system operator. Demand for ancillary services will only continue to grow in the future, in line with the increasing penetration of renewable energies. With FRF-ready UPS, data centres can be part of the solution to the challenges of the energy transition, while creating a revenue-generating asset to support their own profitability.

"The Fortum Spring virtual battery solution is cost efficient," said Ilari Alaperä, Business Development manager at Fortum. "The solution utilises the customer's existing assets to support the power grid without jeopardising the main purpose of the equipment – securing the supply of power for critical processes."

Telia's FRF connection was installed and tested in the summer of 2021. Since then, the Telia UPS installations have contributed several megawatts of capacity to Fingrid. This shows that, while ancillary markets and electricity tariffs vary from country to country, data centres could create an addition $70 000 a year by participating in frequency balancing markets.

UPS with FRF also allows data centre operators to optimise operating costs by as much as 40 per cent through peak shaving – i.e. using battery storage capacity at peak times to avoid paying higher electricity rates. Altogether, this enables a return on investment for UPS equipment that traditionally would not have generated a positive cash flow. And all while driving the development of a cleaner electricity system.

Harri Vilonen concluded: "This cooperation is a great example of how we can make the energy transition happen… by collaborating".

Elina Hermunen is Global Product Manager at ABB Electrification – Smart Power.

With frequency regulation functionality (FRF) UPS equipment can play an active role in supporting data centre operation

Junior Isles

Here Comes the Sun

Following on from last month's 'Final Word', it's probably safe to conclude that Europe's hope of securing additional gas any time soon from Russia with love looks like a pipe dream. In response to Russia recognising Doneske and Luhanske as independent regions within Ukraine – and subsequently launching a full-blown invasion – Germany put the Nord Stream 2 gas pipeline on ice, fuelling fears of a long hard winter.

There is no sugar-coating the implications of the conflict. At an emergency meeting of the UN Security Council just before the invasion, US ambassador to the United Nations Linda Thomas-Greenfield said "the consequences of Russia's actions will be dire – across Ukraine, Europe and the globe". It may be a short time before the world feels the full impact of potential shortages in commodities like wheat and metals, but in the energy sector the effect on Europe has been immediate and will only worsen as the fighting escalates.

While Europe will likely ride-out the current crisis, which has seen wholesale gas prices skyrocket to around 400 per cent higher than a year ago and wholesale electricity prices surge by 260 per cent, the longer term outlook is grim.

Kateryna Filippenko, Principal Analyst, Europe gas research, at global energy consultancy Wood Mackenzie, said: "Mild weather and increased liquefied natural gas (LNG) supplies have softened the impact of continuously low Russian flows and resulted in higher volumes of gas storage.

"Overall, the current supply and storage situation means Europe is in a better position both to navigate 2022 without Nord Stream 2 and to prepare for the next winter."

She warns, however, that 2023 will be more challenging. "If Russian exports to Europe are disrupted, things could obviously get a lot worse… If all Russian gas is cut off, Europe would have no chance of coping. Were all gas flows to stop today, Europe could well muddle through in the short-term, given higher storage inventories and low summer demand.

"But in the event of prolonged disruption, gas inventory couldn't be rebuilt through the summer. We'd be facing a catastrophic situation of gas storage being close to zero for next winter. Prices would be sky high. Industries would need to shut down. Inflation would spiral. The European energy crisis could very well trigger a global recession."

A leaked draft communication from the European Commission obtained by Euractiv, which is due to be published in early March, paints a similarly grim picture of "high and volatile" energy prices until at least 2023, which will drive inflation, impact households and increase costs for businesses.

While the war between Russia and Ukraine will cause a massive external shock to Europe's energy supply, economically, it will serve as a major catalyst to Europe's decarbonisation efforts, forcing European governments to accelerate investment in renewables and deep electrification in order to secure energy independence.

Peter Sobotka, PhD., the founder and CEO of Corinex, a company specialising in improving the efficiency of European energy distribution networks, said: "[In] much the same way the 1970s Opec crisis sparked investment into renewable energy, and set forth new legislation mandating national fuel efficiency standards, this crisis may force Europe to invest at a much faster pace into distributed energy resources, renewables, and demand response technologies to secure its energy future."

With average retail electricity prices across Europe up 30 per cent on last year, certainly it could further increase the uptake of solar on both commercial and residential buildings.

At a recent press roundtable, Naomi Chevillard, Senior Policy Advisor, Solar Power Europe, commented: "Consumers – residential and businesses – are facing higher electricity bills so there's increasing pressure to have the right framework to develop prosumer solutions. This is one of the reasons we are publishing a Solar Strategy at EU level that should provide the right conditions for deployment of solar PV."

She said there were already 14 countries with frameworks for self-consumption, with some interesting frameworks in France and Spain. She said, however, more needs to be done to accelerate deployment, and best practices shared between countries.

As the fall-out from Ukraine-Russia spreads across Europe, interest in how to save on spiralling energy costs, while being more self-sufficient, is rapidly gaining traction among consumers – both big and small.

Also speaking at the roundtable Yogev Barak, Chief Marketing Officer, SolarEdge: said: "The residential market stayed quite resilient throughout the pandemic. The commercial and industrial rooftop market took a little bit of a hit during the pandemic but we are now seeing it come back in a very strong way... This is being driven by more [policy] stability in the market, which is needed for commercial and industrial installations, which are longer term investments. Also, corporations are being judged more and more by their environmental activities and are looking at ways to reduce their carbon footprint."

During the pandemic, and certainly during the run-up to and following the COP26 climate conference, there has been a dramatic increase in awareness of the possibilities presented by clean technologies such as solar.

Speaking at the roundtable, Cormac Gilligan, Associate Director, Solar and Energy Storage, IHS Markit, said: "There has been such a vastly improved awareness amongst homeowners in terms of things like EV adoption; and for this reason solar and energy storage are some of the low hanging fruit that prosumers can do and work towards."

Barak added: "While there are nuances across Europe, generally in people's home there are three things that are contributing to more electricity usage: one is, people are spending more time at home, especially during the Covid era; the second thing is the surge in use of EVs. An EV can on average add 15-20 per cent to household electricity demand. The third thing, which is a bit more subtle but is also gaining traction, is the move from gas-based heating to electrified heating such as heat pumps and HVAC systems.

"On the cost side, the last few months have been significant. In the UK for, example, electricity used to be about £0.20/kWh. Now it's over £0.30/kWh and will probably continue to increase. Several things, including the increase in gas prices, drove this. This is making people look for alternative sources of energy generation like solar. We are seeing more enquiries about solar from our installers."

As gas remains in short supply and electricity prices continue to rise, the cost issue will become key. If homeowners and businesses were perhaps not fully swayed by the economics in the past, that concern is now being swiftly put to bed.

Barak estimates that the payback on a PV system for a typical home in Europe is around 5-7 years, without any government incentives. Giving more detail on those numbers, for a 4 kW solar system for an average UK home, Barak says a system costing £5000 with an estimated generation of 3600 kWh/year, where the home consumes 50 per cent of its own solar generation, would have a payback of 6.5 years. This is at an electricity price of £0.35/kWh with the owner receiving an export payment of £135/year (based on 7.5 p/kWh) from your energy supplier). At an electricity price of 20p/kW, the payback is 10 years.

"From an ROI perspective, it's actually a very good investment," said Barak. "Although the initial investment you have to make might be a detracting factor, from a financial aspect it is already attractive with the prices today."

If the homeowner has an EV, where self-consumption goes to 100 per cent, the business case is even more compelling. At 35p/kWh, payback time falls to perhaps 3-5 years.

While distributed solar is not the complete answer to the gas crisis, it is an important weapon in our armoury. Gas may or may not come from Russia but what is certain is that the sun will always rise. And in the current energy crisis that is reason to be hopeful.

"Here comes the sun, doo da doo doo. Here comes the sun, and I say. It's all right." [The Beatles, 1969].

Cartoon: jemsoar.com