THE ENERGY INDUSTRY TIMES

March 2021 • Volume 14 • No 1 • Published monthly • ISSN 1757-7365 www.teitimes.com

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Shell sets out zero carbon ambition, as OGCs race for renewables

Shell's CEO Ben van Beurden says upstream activites will fund transition

Shell has laid out its plan to reach zero carbon. The plan will see significant investment in renewables, with some arguing that some oil and gas companies are paying too much for renewables assets. **Junior Isles**

Royal Dutch Shell has become the latest oil and gas company (OGC) to announce plans to reach net zero carbon emissions by 2050, highlighting a growing realisation that the future lies in shifting focus away from fossil fuels to clean energy.

The energy major said it plans to continue generating cash from its oil business and "over time" invest more into gas, chemicals, renewables and selling power.

The plan would see net emissions intensity, i.e. the amount of carbon per megajoule of energy sold, fall 6-8 per cent from 2016 levels by 2023, 20 per cent by 2030, 45 per cent by 2035 and 100 per cent by 2050. Shell said on an absolute basis they would also fall to zero.

Stuart Carter a senior oil and gas lawyer at Keystone Law, commented: "Shell's announcement is a modern day 'King Cnut' declaration that they cannot hold back the tide and over the course of the next 30 years will be actively pursuing measures to cut their carbon foot print."

Professor David Elmes, Head of the Global Energy Research Network at Warwick Business School, also noted the new strategy places the company in the growing group of energy companies committing to net zero emissions and transitioning away from being an oil and gas company, but questioned if it can fund the transition. "There are some big technology bets in Shell's plans: carbon capture and storage, more biofuels and replacing natural gas with hydrogen. These need a lot of investment to deliver volume at affordable prices," he said.

Shell hopes to increase its number of electric vehicle charging points from 60 000 to about 500 000 by 2025. It is also putting an emphasis on hydrogen, biofuels, new carbon capture and storage targets and offsets.

It plans to invest $19-$22 billion each year, $8 billion in oil, $4 billion in gas, up to $5 billion in chemicals, up to $3 billion in renewables and "energy solutions" and around $3 billion in marketing.

Explaining how these goals will be funded, Shell's Chief Executive Ben van Beurden said: "Our upstream [oil exploration and production] business will continue to generate the cash and returns needed to fund shareholder distributions, and also to accelerate our transition into the future of energy."

Professor Elmes, however, said that more detail is needed. "When BP launched their new strategy, a discussion among shareholders was, can they earn enough profits to invest in the changes while keeping investors happy with dividends. It's that level of detail that Shell needs to provide."

There has been debate within Shell over how far the company should go. Some executives have called for a faster shift towards renewables, while others remain concerned about diluting legacy businesses, questioning

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Plans for Danish energy hub take shape

A plan to build an energy island in the North Sea has been given the go-ahead by the Danish government, marking an important step in making the North Sea a renewable energy hub for Europe.

The energy hub will be an artificially constructed island 80 km from the shore of the peninsula Jutland. Around 200 wind turbines with a combined capacity of 3 GW are expected to be installed in the first phase of the project. When fully developed, it will reach a capacity of 10 GW.

Giving the green light for the project, the Danish Ministry of Climate, Energy and Utilities said the hub will produce "yet unseen" amounts of green electricity and is one of the government's flagship projects for the green transition in Europe.

Danish Minister for Climate, Dan Jørgensen said: "This is truly a great moment for Denmark and for the global green transition. This decision marks the start of a new era of sustainable energy production in Denmark and the world and it links very ambitious climate goals with growth and green jobs.

"The energy hub in the North Sea will be the largest construction project in Danish history. It will make a big contribution to the realisation of the enormous potential for European offshore wind, and I am excited for our future collaboration with other European countries," said Jørgensen.

The island will act as an offshore power plant generating electricity from the wind turbines installed around the island and distributing it directly to consumers in countries surrounding the North Sea.

"We are at the dawn of a new era for energy," said Jørgensen. "The EU has set a goal to achieve climate neutrality by 2050 and the Commission has set a target of 300 GW of offshore wind energy in order to attain this goal. By constructing the world's first energy hub with a potential capacity of 10 GW, Denmark significantly contributes to this ambitious target. Not only by dramatically expanding renewable energy production, but also by supplying our European neighbours with an abundance of renewable energy."

The energy island will be a public-private partnership between the Danish state and private companies. Denmark will own the majority of the island, but private companies will be crucial for the project to fulfill the potential with regards to innovation, flexibility, cost-effectiveness, and business potentials, the Ministry said.

In a related development, last month Denmark-based green hydrogen producer Everfuel A/S said its green hydrogen project in the Danish peninsula of Jutland will lead efforts to build a green fuel hub in the region. The company is joining a partnership, which also includes local consultancy COWI, Ørsted, Vattenfall and the Frederica refinery.

Together the partners are currently working to build industrial-scale power-to-X facilities in the Triangle Region for hydrogen production from renewable energy. Everfuel's 20 MW HySynergy project is expected to be in operation from the middle of 2022.

A second phase of the project is being planned, which could expand capacity with a 300 MW electrolyser, due to be operational by 2025, the company said. The facility will produce green hydrogen but Everfuel is also considering production of ammonia and methanol for green marine and aviation fuels.

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whether they can count on similar levels of returns from lower-carbon divisions.

Concerns have been raised on the price energy majors have been paying for renewable assets.

In a recent interview with the *Financial Times*, Patrick Pouyanné, Chief Executive of Total, said renewable energy assets are in a bubble leading to several deals with over-priced valuations.

Total has promised billions in renewables investment, targeted net-zero emissions by 2050 and proposed renaming the company TotalEnergies, a move which its shareholders will vote on in May.

Pouyanné cautioned that renewable energy assets are "in a bubble"

Pouyanné cautioned, however, "there is a bubble" in the renewables sector. Valuations that are often up to 25 times earnings are "just crazy today", he added, putting that down to the short supply of assets of a significant scale. They are "too scarce" he said.

Total was one of several major oil companies, BP among them, that last month paid what one analyst described as "staggering" prices for the leases to UK offshore wind projects.

Some experts, however, believe the high cost of investment will be worth it in the long run.

Bruce Wen, Energy Consultant at BJSS said: "The earlier OGCs start to invest, the more they will benefit from the electrification value chain tomorrow. Although the renewable assets are valued at a premium right now and seem to be in a bubble, it is very likely that they will provide high returns in the future – both tangible and intangible."

BP's Dev Sanyal, who is responsible for its alternative energy business, said that value is the "key driver" when it does deals and that it would not just invest in any asset to meet renewable targets.

New analysis by Westwood Global Energy Group (Westwood), the specialist energy market research and consultancy firm, revealed Total will outpace clean energy majors Iberdrola and Ørsted on renewable power capacity by 2030. Total's ambition to reach 100 GW of renewable power capacity by 2030, it said, is eclipsed only by utility Enel, which aims to have 145 GW.

Meanwhile, at the end of January, BP took an important step in its goal to deliver 50 GW of renewable capacity by 2030 with the completion of the formation of its strategic US offshore wind partnership with Equinor. This includes BP's $1.1 billion purchase from Equinor of a 50 per cent interest in two major lease areas off the US East Coast.

Green hydrogen may be competitive sooner than expected

- Market will double nine times by 2050
- Cost of green hydrogen could compete with alternatives by 2030

Junior Isles

Green hydrogen is set to play a significant role in the energy mix with its development likely to happen faster than expected as costs of production fall.

According to a new report by Wood Mackenzie the low carbon hydrogen market will double nine times by 2050, initially driven by Europe. The report – 'The hydrogen possibility: a 2050 outlook' – says that while Europe will drive most growth from 2020-2035, by the late 2030s China and the US will become the world's largest hydrogen markets.

It is expected that growth will grow as production costs fall faster than expected as the industry continues to scale.

In February a group of 30 European energy-focused companies announced that they are working on a project to produce and deliver 100 per cent green hydrogen across the Continent at a price of fossil fuels before 2030. The group behind the project, known as HyDeal Ambition, said the alliance can achieve the cost of solar-made hydrogen at the price of €1.5 ($1.82) per kg, including transmission and storage.

Separately electrolyser manufacturer Nel recently set a target of $1.5/kg by 2025, down from the current price of about $4/kg.

"This is going to move faster than anyone forecasts, even us. But that's just the nature of this, because this is so dynamic," Ben Gallagher, senior analyst at Wood Mackenzie and author of the report, told *GreenTech Media*. "The trajectory of the green hydrogen market will be determined by the amount of policy support in its early years, and the amount of corporate commitments that are made to invest in this technology. And both of those things are moving much faster than expected."

Europe is targeting 40 GW of electrolyser capacity by 2030, a figure that looks set to be surpassed.

The number of planned or announced hydrogen projects across Europe is almost double that of current operational projects as demand for clean energy solutions heightens globally, according to new research by global law firm DLA Piper and inspiratia.

DLA Piper's report 'The Hydrogen Revolution in EMEA' shows that there are 192 planned or announced hydrogen projects in Europe compared to 107 current operational projects.

Of the 228 hydrogen projects announced globally, 55 per cent of them – 126 projects – are in Europe, business group the Hydrogen Council said in its first tally of the global project pipeline, done with consultancy McKinsey.

The EU currently has less than 0.1 GW of electrolysers, but that figure is growing rapidly.

Last month saw Siemens Energy conclude two important agreements in the area of hydrogen and low carbon technologies. The company signed a Memorandum of Understanding with Air Liquide aimed at combining their expertise in PEM (Proton Exchange Membrane) electrolysis technology. They intend to focus their activities on these key areas: co-creation of large industrial-scale hydrogen projects in collaboration with customers, laying the ground for mass manufacturing of electrolysers in Europe, especially in Germany and France, and R&D activities to co-develop next generation electrolyser technologies.

It also formed a strategic partnership with BASF to accelerate commercial implementation of new technologies designed to lower greenhouse gas emissions. Possible pilot projects include the construction of a PEM electrolyser with an output of 50 MW with the possibility of modular capacity expansions.

Countries must ramp up climate pledges

Global greenhouse gas cutting ambition must nearly double to avoid the most catastrophic effects of climate change, according to a recent study.

New research published in *Communications Earth & Environment* found that even if countries were to meet their existing pledges, the world has only about a 5 per cent chance to keep global warming to "well below" 2°C above pre-industrial levels, as set out in the 2015 Paris agreement.

Adrian Raftery, a University of Washington statistics professor and co-author of the study said "the commitments are not enough", stressing that global emissions would need to fall steadily – about 1.8 per cent each year on average – to put the world on a more sustainable trajectory. Emissions have risen about 1.4 per cent annually on average over the past decade, not including the dramatic fall in 2020 caused by the coronavirus pandemic.

Last month, new research from BloombergNEF (BNEF) showed the world's largest economies are far from having the right policy plans in place to meet the climate pledges made following the COP21 meeting in 2015.

Its 'G20 Zero-Carbon Policy Scoreboard', which evaluates the G20 countries' decarbonisation policies, finds that despite impressive headline goals, follow-through efforts are badly lacking ahead of the COP26 climate meeting scheduled for the end of this year in the UK.

"The high-level pledges over the last year, in particular, have been impressive with major economies such as the European Union, Japan, South Korea and China all promising to get to 'net-zero' emissions or carbon neutrality at some future date," said Victoria Cuming, Head of Global Policy Analysis for BNEF. "But the reality is that countries simply haven't done enough at home with follow-through policies to meet even the promises made more than five years ago."

Much of the progress to date in cutting CO_2 emissions has come in the power sector but the report finds other major segments of the global economy, such as road transport, green fuels, buildings, industry and the circular economy, are lagging.

"While some power sector policies have delivered results, most countries have done little elsewhere in the economy," said Cuming. "And even within each sector, it's not enough to implement incentives for one technology – multiple pathways are required."

Even the EU, which has set a new 2030 emissions target of a 55 per cent reduction over 1990 levels, is still off the pace.

As noted in the Wood Mackenzie report – 'Fast and furious: Europe's race to slash emissions by 2030' – Wood Mackenzie's base-case forecast sees the bloc falling short of its goal, delivering a 46 per cent reduction over 1990 levels.

An accelerated energy transition for the EU, consistent with limiting global warming to no more than 2°C, would take Europe much closer to the 2030 target. Wood Mackenzie's 2°C scenario includes some sharp changes from their base-case scenario: electric vehicles and plug-in hybrids must reach 97 per cent of EU passenger vehicle sales by 2030; wind and solar capacity must grow by 162 GW and 253 GW, respectively, over 2020 levels – underpinned by rapid scaling of grid infrastructure; and coal plant retirements, of 85 GW by 2030, must be accelerated, alongside a carbon cost that maximises coal-to-gas switching.

However, even that 2°C scenario only gets the EU to a 53 per cent cut in emissions by 2030; it would take another two years to get to 55 per cent, Wood Mackenzie said.

Corporations drive green growth

Corporations are at the forefront of the push towards greening the economy, recent data reveals.

Corporations purchased a record of 23.7 GW of clean energy in 2020, up from 20.1 GW in 2019 and 13.6 GW in 2018, according to new research published by BloombergNEF (BNEF). The increase came despite a year devastated by the Covid-19 pandemic, a global recession and uncertainty about US energy policy ahead of the presidential election.

BNEF finds in its '1H 2021 Corporate Energy Market Outlook' that clean energy contracts were signed by more than 130 companies in sectors ranging from oil & gas to big tech. Underpinning the market is surging stakeholder interest in corporate sustainability and expanding access to clean energy globally.

Kyle Harrison, BNEF senior associate and the lead author of the report, commented: "Corporations faced a wave of adversity in 2020 – internal corporate functions were disrupted on the outset of the pandemic, and many companies saw revenues plummet as global economies buckled. Question marks before – and after – the US election further complicated long-term decision-making for companies. To not only maintain, but grow, the clean energy procurement market under these conditions is a testament to how high sustainability is on many corporations' agendas."

The US was once again the largest market, but was less dominant than in previous years. Companies announced 11.9 GW of corporate PPAs in 2020, down from 14.1 GW in 2019 – the first year-on-year drop since 2016. The first half, coinciding with the start of the pandemic, was particularly subdued, with companies announcing just 4.3 GW of corporate power purchase agreements (PPAs) in that period.

Latin America was also down, with PPA volumes dropping from 2 GW in 2019 to 1.5 GW in 2020.

While the US and Latin America slipped back, other corporate procurement markets stepped up. Corporate PPA volumes in the Europe, Middle East and Africa (EMEA) region nearly tripled, from 2.6 GW in 2019 to a record 7.2 GW in 2020.

Mexican president raises fears over legislation to roll back renewables framework

- New fears over investment in wind and solar
- Potential for legal action by north American investors

Janet Wood

The Global Wind Energy Council and Global Solar Council have now added their voices to calls for the government of Mexico to halt reversals to key parts of the country's Electricity Act. Entrepreneurs and experts have also recently spoken out against changes that will give priority to public companies. President Andrés Manuel López Obrador has so far stood firm against opposition.

The change would prioritise hydroelectric and fossil fuel plants owned by the Federal Electricity Commission (CFE), the State company for dispatch, over private renewables plants and finally combined cycle gas turbines. It also eliminates the obligation for electricity auctions in which the private sector can participate, changes the clean energy certificate rules to allow ageing hydropower to claim more, and orders a review of federal government contracts with private energy producers.

López Obrador recently said previous governments had "looted" state energy companies and private companies "handed out millions" of pesos to MPs and senators. He said: "I don't get paid by foreign entrepreneurs, I get paid by the people of Mexico."

A report by the Chamber of Deputies warned that the initiative puts 105 solar and wind energy projects totalling $22.58 billion at risk. It is also set to damage relations between Mexico and its investing northern neighbouring countries. A separate estimate said it put $41 billion in private sector investments in electricity generation at risk and suggested it would trigger lawsuits, including under the USMCA free-trade treaty with the US and Canada.

Mexico's Business Coordinating Council (CCE) criticized the initiative in unusually strong terms, saying it would lead to higher energy prices and "irretrievably" damage regulatory and procurement certainty in Latin America's second economy, adding, "It opens the door to indirect expropriation of private plants by changing the legal framework". Roger González, Chairman of the Energy Commission of the Business Coordinating Council, warned that "it was vital to respect the contracts already acquired".

El Salvador cuts through renewables confusion

El Salvador is set to step up its renewable energy investment after one of its largest banks, Banco Davivienda Salvadoreno, agreed a loan package of up to $100 million. The cash injection came from IDB Invest, a member of the Inter-American Development Bank Group, and co-financiers.

IDB Invest will also provide advisory services for Banco Davivienda Salvadoreno on how to originate renewable energy and energy efficiency projects with a focus on photovoltaic (PV) plants. The bank is already one of the financiers of the country's first wind farm.

Imported fossil fuels make up a third of El Salvador's power supply but plans to invest in more renewables instead have been in disarray. Now a new action plan has been endorsed by President Nayib Bukele.

"El Salvador has taken irrefutable steps, ordering the national electricity sector and seeking to diversify the energy matrix, promoting renewable energy resources such as hydroelectric, geothermal, solar photovoltaic and wind," said Daniel Alvarez, President of the Executive Hydroelectric Commission of the Lempa River.

IDB Invest financing will focus on solar PV

Brazil sees wind and solar power records broken

Brazil's installed wind power capacity has reached 18 GW, according to national wind energy association Abeeolica.

The country now has 695 operational wind farms, according to the association. Its president, Elbia Gannoum, said that Brazil will have at least 28 GW of installed wind power capacity by 2024, taking into account only contracts awarded through power auctions.

Meanwhile investment in solar PV continues to expand as Enel recently announced a further extension at São Gonçalo, South America's largest solar PV facility, which recently entered operation. Enel will invest $142 million to add a further 256 MW, which will bring its capacity to 864 MW, making it Enel's largest power generation facility under construction worldwide.

"Bringing online the first expansion of our record-breaking São Gonçalo solar park is a major step forward for Enel in Brazil, strengthening our position as leaders in the country's solar generation market," said Salvatore Bernabei, CEO of Enel Green Power and Head of Enel's Global Power Generation business line.

Renewables set to pass a third of US capacity by 2025

- Major projects attract new investors
- New York State seeks to lead on community solar

Renewables are on track to reach 30 per cent of US total generating capacity by 2025 and may exceed that, according to new figures.

Renewables dominated investment in US power projects in 2020, according to Federal Energy Regulatory Commission (FERC) data, and its project pipeline remains strong.

Biomass, geothermal, hydropower, solar and wind accounted for 22.4 GW of the total 28.7 GW of new utility-scale capacity added last year. Wind (13 626 MW) and solar (8543 MW) each contributed more new generating capacity than did natural gas (6259 MW).

Wind farms added 5004 MW in December alone and provided nearly half (47.39 per cent) of the new capacity for the year.

Discussing the US market, Mohamed Jameel Al Ramahi, Chief Executive Officer of Masdar, said: "The US offers considerable scope for further growth, and with President Joe Biden having made clean energy investment a key priority for his administration, we clearly anticipate greater opportunities in this market." His comment came as Masdar announced the acquisition of 50 per cent of a 1.6 GW clean energy portfolio of projects in the USA from EDF Renewables North America.

The partnership covers eight projects, including three utility-scale wind projects in Nebraska and Texas totalling 815 MW and five solar projects in California totalling 689 MW – two of which include lithium-ion battery energy storage systems representing 75 MW. All three wind projects are currently in the final stage of construction and expected to begin commercial operations shortly.

The renewables sector has recently attracted new investors including fossil companies. Total has acquired a development pipeline of 2.2 GW of solar projects, and 600 MW of battery storage assets, in Texas.

Key new technologies include offshore wind. Massachusetts recently published a first call for up to 1600 MW of offshore wind, doubling current projects.

New York State has announced plans for 40 new community solar projects earmarked for completion by 2025, aiming to build 75 MW of solar capacity paired with 15 MW of battery storage. The initiative is open to municipal communities including counties, towns, cities and villages, as well as state agencies.

Governor Andrew M. Cuomo said: "Partnering with local governments and state agencies for community projects will further solar and storage deployment, while creating new jobs all across the state."

Among early sites, Rick Cotton, ex-Executive Director, Port Authority of New York and New Jersey, said: "JFK Airport will host New York State's largest solar power canopy system," while Tom Roach, Mayor of the, City of White Plains, said: "White Plains is moving ahead with an eight-project, 6.6 MW community solar portfolio."

The state's Climate Leadership and Community Protection Act calls for installing 6 GW of solar by 2025 and 3 GW of energy storage by 2030.

Blackouts give urgency to calls to expand US grid

Blackouts in Texas and elsewhere in the southern USA have placed a new spotlight on plans due to be published by President Joe Biden for "historic investment" in US transmission systems and battery storage.

The aim of the plan is to make the transmission and distribution system more resilient amid extreme weather spurred by climate change, and help meet increased demand nationwide as more electric vehicles hit the roads and more buildings rely on power instead of natural gas for heat.

The Texas cold snap mirrors similar problems in 2020 when a heat wave in California caused rolling blackouts, as residents turned up air conditioners, causing electricity demand to spike.

A study from WIRES, a trade group that advocates construction of high-voltage transmission, says to accommodate a renewables-based system investment is needed on the order of $90 billion by 2030 and $600 billion by 2050.

Heather Zichal, head of the American Clean Power Association, said the outages "show why we need to be investing in building out more renewable energy sources with better transmission and storage to replace outdated systems".

Meanwhile 12 states have promised to take action on grid upgrades, with a Blueprint for State Action and five Roadmaps for Comprehensive Electricity Planning.

India can avoid high carbon future, says IEA

- Energy demand is set to grow about 35 per cent by 2030
- Clean technology path will require $1.4 trillion

Syed Ali

India has a huge opportunity to bring electricity to millions of its citizens without following the high carbon path that other countries have followed, says the International Energy Agency (IEA).

In its 'India Energy Outlook 2021', the Paris-based said India's ability to ensure affordable, clean and reliable energy for its growing population will be vital for the future development of its economy, but doing this in a low carbon way will require strong policies, technological leaps and a surge in clean energy investment.

The India Energy Outlook 2021 – a special report in the IEA's World Energy Outlook series – examines the opportunities and challenges faced by the planet's third-largest energy consuming country as it seeks to recover from the Covid-19 crisis. India is set to experience the largest increase in energy demand of any country worldwide over the next 20 years as its economy continues to develop.

The nation's energy needs are expected to grow at three times the global average under today's policies. Energy use has doubled since 2000, with most of that demand met by coal and oil. Energy demand is set to grow about 35 per cent by 2030, down from the 50 per cent forecasted before the coronavirus pandemic.

"India has made remarkable progress in recent years, bringing electricity connections to hundreds of millions of people and impressively scaling up the use of renewable energy, particularly solar," said Dr Fatih Birol, the IEA Executive Director. "What our new report makes clear is the tremendous opportunity for India to successfully meet the aspirations of its citizens without following the high-carbon pathway that other economies have pursued in the past."

More than that of any other major economy, India's energy future depends on buildings and factories that are yet to be built, and vehicles and appliances that are yet to be bought. Based on India's current policy settings, nearly 60 per cent of its CO_2 emissions in the late 2030s will be coming from infrastructure and machines that do not exist today. This represents a huge opening for policies to steer India onto a more secure and sustainable course, says the report.

The IEA says this pathway will call for widespread electrification of processes, greater energy efficiency, the use of technologies like carbon capture, and a switch to progressively lower-carbon fuels.

It notes, however, that these transformations, "on a scale no country has achieved in history", will require huge advances in innovation, strong partnerships and vast amounts of capital. The additional funding for clean energy technologies required to put India on a sustainable path over the next 20 years is $1.4 trillion, or 70 per cent higher than in a scenario based on its current policy settings, says the report. But the benefits are huge, including savings of the same magnitude on oil import bills.

Birol said policymakers needed to ensure the next wave of growth is met with renewable energy sources such as solar. "India has a huge potential to be the kingmaker in solar electricity, because it is very cheap," Birol said.

According to a recent data from Mercom, the share of solar power in India's installed power capacity mix reached 10.3 per cent, exceeding that of wind-based power sources for the first time.

Solar, however, still only represents 4 per cent of generation, with coal still providing 70 per cent of the country's electricity. And despite impressive gains in renewables, the country still continues to make large coal capacity additions. In February, Bharat Heavy Electricals Limited (BHEL) successfully commissioned the second unit (800 MW) of the 2x800 MW Gadarwara supercritical coal fired power plant in Madhya Pradesh.

- A Statement of Intent has been signed between IndianOil Corp. Ltd. and M/s Greenstat Hydrogen India Pvt. Ltd., a subsidiary of Greenstat Norway for setting up of a Centre of Excellence on Hydrogen (CoE-H). The Government of India is giving more attention to exploration of new and emerging forms of energy such as carbon capture usage and storage (CCUS) and fuel cells.

South Korea plans world's largest offshore wind farm

South Korea says it will build the world's largest wind farm by 2030, as part of a green economic recovery following the Covid-19 pandemic.

The 8.2 GW offshore wind power complex in Sinan, South Jeolla Province, is one of the main components of South Korean President Moon Jae-in's New Green Pact, which began last year to curb dependence on fossil fuels in Asia's fourth economy and make it carbon neutral by 2050.

Moon said the project will require an investment of about Won48.5 trillion ($43.2 billion) and will create 5600 jobs. The project will also be central to helping the government achieve its target to increase the country's wind capacity to 16.5 GW by 2030, up from the current 1.67 GW.

South Korea has set a goal of becoming by 2030 one of the top five nations when it comes to offshore wind power generation.

Indonesia sets out smart grid programme

Indonesia has outlined its smart grid development programmes, in a move it hopes will improve grid reliability and efficiency.

Under a new government plan, five new systems will be installed in Java-Bali between 2020 and 2024, reaching a total of 25 systems by the end of the period.

The Ministry of Energy and Mineral Resources Republic of Indonesia said in a statement issued in February: "In increasing the reliability of the electric power system, smart grid is believed to be one of the solutions to increase efficiency in services to the community. In addition, smart grids can increase transmission flexibility [in order] to receive more Variable Renewable Energy (VRE)."

Speaking at a webinar, Secretary of the Directorate General of Electricity Munir Ahmad, said: "The use of smart grid technology is not limited to urban and large-scale electricity consumers. Smart grid technology can also be utilised on small-scale smart microgrids in rural and remote areas with difficult access to the transmission network."

State power utility PLN has already conducted several smart grid pilot projects. Smart grid implementation will initially focus on reliability, efficiency, customer experience and grid productivity. In the next stage PLN will focus on resilience, customer engagement, sustainability and self-healing.

Australia and Japan lead Asia's hydrogen charge

■ Asia has 38 GW project pipeline ■ Feasibility study planned for Kogan Creek project

Syed Ali

Increasing government support and rising investor interest in several key Asia-Pacific markets, especially Australia and Japan, is driving growth opportunities in the green hydrogen sector, according to Fitch Solutions Sector Intelligence.

The research group says that while the production of hydrogen is not new, it sees increasing traction in electrolyser technologies as a carbon-free alternative. In a research note it stated: "Based on the current Asia project pipeline of 38 GW and developing trends, we expect significant upside risk to capacity growth as more projects are likely to be announced with accelerating momentum."

Of the biggest 13 hydrogen projects announced in 2020, five were in Australia. While commenting on these developments at the recent Hydrogen Transition Summit hosted by Climate-Action, Dr Alan Finkel, Australia's Chief Scientist, also said that other projects are in the pipeline that will bring scale. "We have a project that is awaiting a Final Direct Investment decision, hopefully within the next few years. That's a 26 GW wind and solar project that will produce hydrogen and ammonia primarily for export."

Dr Finkel also noted that in Japan there is an opportunity to replace coal used in power plants with ammonia produced from hydrogen, something he says "could be done relatively quickly".

Meanwhile projects are continuing apace. At the start of February, CS Energy formed a partnership with IHI Corporation of Japan to assess the feasibility of building a renewable hydrogen demonstration plant next to an existing coal fired power station in South West Queensland, Australia.

The Queensland government-owned energy company and the Japanese engineering firm will start with a feasibility study into the Kogan Hydrogen Demonstration Plant concept. The idea is to co-locate a solar farm, battery, hydrogen electrolyser and a hydrogen fuel cell at the 750 MW Kogan Creek power station near Chinchilla. The hydrogen electrolyser will only be powered by behind-the-meter solar energy, according to the announcement.

The country is expanding efforts at both national and state level. The Australian centre for industrial growth in the field of energy resources, National Energy Resources Australia (NERA), recently announced that it is building a virtual network of 13 regional hydrogen technology clusters across Australia. The aim is to support the development of a hydrogen supply chain and to identify gaps in the development, use and commercialisation of new hydrogen-oriented technologies. In February, the state of Victoria also said it is providing the equivalent of €6.41 million to promote hydrogen research.

■ Developers plan to build what they say will be the world's biggest large-scale battery in the New South Wales Hunter Valley, the latest in a flurry of major energy storage projects announced for the national electricity grid. CEP Energy said its $2.4 billon battery at Kurri Kurri, northwest of Newcastle, would have a power capacity of up to 1200 MW – about eight times bigger than the battery at Hornsdale in South Australia, which was the largest when it began operating in 2017.

Bangladesh drafts wind sector guidelines

The Bangladeshi government has unveiled draft guidelines for building onshore wind power plants, as part of its efforts to grow clean energy generation in the country.

According to officials, project developers will first have to ensure the availability of suitable sites with land use permission, check the availability of wind resources, technically and commercially feasible grid connectivity, transport logistics and environmental acceptability to setup wind power projects.

The Sustainable and Renewable Energy Development Authority (SREDA), which published the guidelines, said it will collaboratively work with developers to ensure that project documents meet international banking requirements for standard project financing.

According to the government's wind map, Kutubdia, Chakaria and Maheshkhali in Cox's Bazar district, Kalapara in Patuakhali district and Sonagazi in Feni district are suitable sites.

"The government wind map will give you an idea about wind speed. Before setting up of a project, you have to conduct a study to get real wind velocity," said SREDA Chairman, Mohammad Alauddin.

The Bangladesh Power Development Corporation (BPDB) in September last year floated a tender for setting up two wind power projects with a capacity of 50 MW each – one in Chandpur and another in Cox's Bazar.

In December, another 55 MW project received approval from the cabinet committee on government purchase. This will be set up in Mongla in Bagerhat district.

ADB supports Thailand low carbon drive

The Asian Development Bank (ADB) has demonstrated its support for renewable power development and electric vehicle deployment in Thailand with the recent award of a multi-million dollar loan to Energy Absolute Public Company Limited (Energy Absolute).

The bank has agreed to provide Energy Absolute with Baht1.5 billion ($50 million) to finance the Nakornsawan solar and Hanuman wind power plants, and roll-out fast and standard chargers at charging stations across the country.

The green loan is certified by the Climate Bond Initiative and is the first climate loan in the Asian country with this certificate, said ADB. The bank said it aims to increase awareness of green financing by continuing to support Thailand's renewable energy sector and investing in the electrification and decarbonisation of its transport sector.

Department Infrastructure Finance Division Director for East Asia, Southeast Asia and the Pacific, Jackie B. Surtani, commented: "ADB sees Energy Absolute's leadership in green investment as an invaluable step in developing the financing of renewable energy in the region."

Thailand aims to be a regional leader in EVs to reduce greenhouse gas emissions from conventional transportation, which currently accounts for around 26 per cent of the country's total annual CO_2 emissions.

Energy Absolute is the largest renewable energy company on the Thailand Stock Exchange. Its six renewable projects have a total capacity of 664 MW. It is also a producer of biodiesel.

Japan completes global hydrogen chain system

■ Supply chain system ready for commercial use

■ Rosatom can meet up to 40 per cent of Japan's hydrogen demand

Syed Ali

A group of Japanese companies have completed a project, which they say demonstrates the world's first global hydrogen supply chain.

The news was announced by Chiyoda Corporation, together with Mitsubishi Corporation, Mitsui & Co. Ltd and NYK Line, together with other members of the Advanced Hydrogen Energy chain Association for technology Development (AHEAD). The demonstration project, launched in 2015, was subsidised by the New Energy and Industrial Technology Development Organization (NEDO).

Demonstration was part of the project's second phase (2017-2020) that included the design, procurement, construction and operation of facilities to validate the feasibility of the global hydrogen supply chain, based on the results of an infrastructure technology study completed in the first phase (2015-2017).

The hydrogen supply chain, which maximises the use of existing infrastructure and meets international safety standards, commences with the procurement of hydrogen in the source country, overseas transportation to consuming countries in the form of methylcyclohexane (MCH) and distribution using Chiyoda's SPERA Hydrogen technology.

By transporting and storing over 100 tons of hydrogen over ten months, the demonstration verified that the system, an example of Japanese environmental technology, is technically ready for commercial use and confirmed SPERA Hydrogen's potential contribution to global carbon neutrality in 2050. Chiyoda will now expand the system towards semi-commercialisation by the mid-2020s, reducing costs through economies of scale in line with increased hydrogen demand.

Japan is among the world's leaders in creating a hydrogen economy and has been building its hydrogen production and distribution capabilities as it increasingly uses the green gas for transport in particular.

The country received a boost to its plans to satisfy future demand when in February Russia's Rosatom said it is capable of meeting up to 40 per cent of Japan's hydrogen demand by the end of the next decade.

The organisation of hydrogen production in Sakhalin Oblast, which is close geographically to the coast of Japan, is being considered as a priority scenario for the Japanese export project, so that liquefied hydrogen can be efficiently delivered by sea to consumers in Japan.

"Potentially, Rosatom could supply up to 30-40 per cent of Japan's hydrogen demand by 2030. Should the feasibility study be successful, it will be possible to talk about starting a project to organise a global hydrogen supply chain, and in the future about the formation of a unique low-carbon hydrogen cluster," the state corporation said.

"We are interested not only in organising hydrogen exports from Russia to Japan, but also in developing technological cooperation and, of course, in this regard it's not only the Japanese hydrogen market, but also the unique technologies of Japanese companies that are of great interest to us," Rosatom said.

Europe's growing offshore wind target needs €600 billion in grid expansion

- Increasing deployment targets need grid investments
- Spain, UK look to floating options

Janet Wood

Last year Europe built 2.9 GW of offshore wind, bringing the total to 25 GW, but the EU's latest target – now excluding UK projects – is 300 GW by 2050. According to the Commission, investment needed for this amounts to almost €800 billion, two-thirds of which would be spent on network infrastructure.

That is one of the drivers behind Denmark's plans to build an artificial island in the North Sea. The UK has also put forward plans for North Sea wind farms to be connected directly to continental Europe. "Clearly this is too much for Denmark alone and this is also why we see this as a part of a bigger European project," said Denmark's Minister for Climate, Energy and Utilities Dan Jørgensen.

The plans reflect Europe's growing targets for offshore wind. Europe saw a record €26.3 billion of investments in offshore wind farms in 2020, in 7.1 GW of new capacity.

The sector has begun to attract new investors, including oil majors, but BP plc and Total SE recently paid substantial prices to enter the industry, ahead of many of the utilities that have dominated it until now when the UK's Crown Estate auctioned seabed rights that will allow about 8 GW of new wind farms. The winners will pay about $1.2 billion per year in total for up to a decade to develop the wind farms.

The success of the offshore wind industry has driven interest in moving further offshore and using floating structures. A new study from the UK's Offshore Renewable Energy Catapult says large floating wind projects could offer prices below current wholesale electricity price forecasts by 2029. To achieve that, it recommends raising the UK target of 1 GW of floating offshore wind by 2030 to 2 GW, with a further 4 GW in the early 2030s. An offshore leasing round should be established in the next two years.

However, the UK is in danger of seeing other countries take the lead in floating wind. Iberdrola said recently it is planning to invest more than €1 billion to develop a 300 MW installation off Spain to be operational in 2026.

The project would spearhead the development of up to 2 GW of floating projects identified by Iberdrola off Galicia, Andalusia, and the Canary Islands.

Spain wants to use the first project to develop the country's supply chain and establish it as an international benchmark. Iberdrola has one of the largest offshore wind pipelines in the market, amounting to over 30 GW worldwide.

In mid-December Jørgensen noted that Denmark took the decision to phase-out oil and gas production by 2050 and that Denmark and Germany were taking "another leap forward" by strengthening the cooperation to jointly develop and connect the offshore wind energy hubs.

He said: "This will not only increase renewable power production considerably in both countries. It is also a prerequisite for power-to-X technologies to produce sustainable fuels for shipping and aviation."

In the long term, Denmark plans to establish energy hubs with a total capacity of 12 GW of offshore wind energy in the North Sea and Baltic Sea.

Poland puts its faith in offshore wind

- A third of power to come from renewables in ten years
- First offshore wind auction within months

Offshore renewable energy will play a key role in Poland's plan to decarbonise its energy sector, Minister Michal Kurtyka said recently.

Kurtyka, taking part in the recent Global Policy Forum, said that the transformation of the Polish energy sector would take many years due to the investment required and the scale of the technical and economic challenge.

"The implementation of the policies and activities included in the National Energy and Climate Plan of Poland for 2021-2030 and the updated Polish Energy Policy until 2040 will put us on the threshold of achieving climate neutrality in tune with the assumptions of the Paris Agreement. Poland must ensure the safe production of cheap and clean energy to reduce dependence on fossil fuels," stressed Minister Kurtyka. He added: "Within the next 10 years every third MWh of electricity produced will come from renewable units."

He said offshore wind would "play a key role" with its installed capacity reaching 11 GW in 2040.

Poland recently signed into law the Offshore Act, which regulates the development of offshore wind farms in the Polish Baltic Sea. It will allow for 10.9 GW of offshore wind capacity to be either operational or under development by 2027.

The first tranche, of some 5.9 GW will be offered via Contracts for Difference (CfD) auctions by the end of June 2021.

Among the first is expected to be a joint venture by Ørsted and PGE Polska Grupa Energetyczna. They recently signed an agreement for the development, construction and operation of the 1.5 GW Baltica 2 and 1 GW Baltica 3 offshore wind farms.

Poland plans to cap the maximum price of electricity produced at offshore wind farms selected in this year's auctions at €67.08/MWh. The price cap was introduced in draft regulations from Poland's Ministry of Climate and Environment.

Ukraine's power sector needs more competition and safety upgrades

Ukraine should increase competition in its electricity market, according to a new European Parliament resolution.

The European Parliament's resolution of February 11, 2021 on the implementation of the EU Association Agreement with Ukraine said: "The new wholesale electricity market that started operating in Ukraine in July 2019 is still not competitive by EU standards. Therefore, we urge Ukraine to complete its reform and improve the level of compliance with EU law, first and foremost by enhancing Ukrenerho's independence and avoiding cross-subsidisation." The market was set in place in July 2019.

The EU was concerned that Ukraine is not meeting its obligations towards renewable energy investors, with payment delays to renewable generators, and this threatens the further development of clean energy sources in Ukraine.

The EU also wanted Ukraine urgently to modernise its nuclear power plants.

"We stress the importance of increasing infrastructure cooperation in the region, the further diversification of Ukraine's energy supplies, energy efficiency, renewable energy sources and the connectivity of Ukraine's energy sector, while ensuring environmental sustainability," the resolution said.

New insurance fund to accelerate ocean energy's roll-out

Ocean Energy Europe (OEE) has kicked off design of a new European insurance fund for the ocean energy sector, intended to cut the costs of the first commercial projects and accelerate roll-out. Renewable Risk Advisers will carry out the work as part of the EU-funded OceanSET project.

The group says de-risking projects this way can help scale up ocean energy, by enabling more projects to reach financial close.

The project comes as the European Commission announced plans to coordinate with national governments to fund 100 MW of ocean energy by 2025, and 1 GW by 2030.

Donagh Cagney, OEE's Policy Director said: "The sector's scale-up has already begun, and instruments such as the insurance fund will be crucial to further accelerate this growth."

OceanSET Project Lead, Patricia Comiskey, commeneted: "This is one of the key financial actions identified in the SET Plan for Ocean Energy and will be a significant step to help remove hurdles for the ocean energy industry."

Meanwhile Finland's AW-Energy Oy has sought a new ocean energy niche in the commercial hydrogen market.

It has proposed a combined WaveRoller and HydrogenHub process for the production of green hydrogen. "Wave energy holds the greatest potential to generate constant low-cost green hydrogen," said Chief Executive Christopher Ridgewell.

UK nuclear costs rise but advocates call for European projects

The expected cost of Hinkley Point C, EDF's new nuclear station in England, has risen by £500 million ($696 million) and start up has been delayed to 2026, the company said recently. The project is now expected to cost £23 billion. Stuart Crooks, Managing Director of Hinkley Point C, said: "A longer construction period adds some cost – as does the reduced efficiency of operating a site for a long period under Covid-19 conditions."

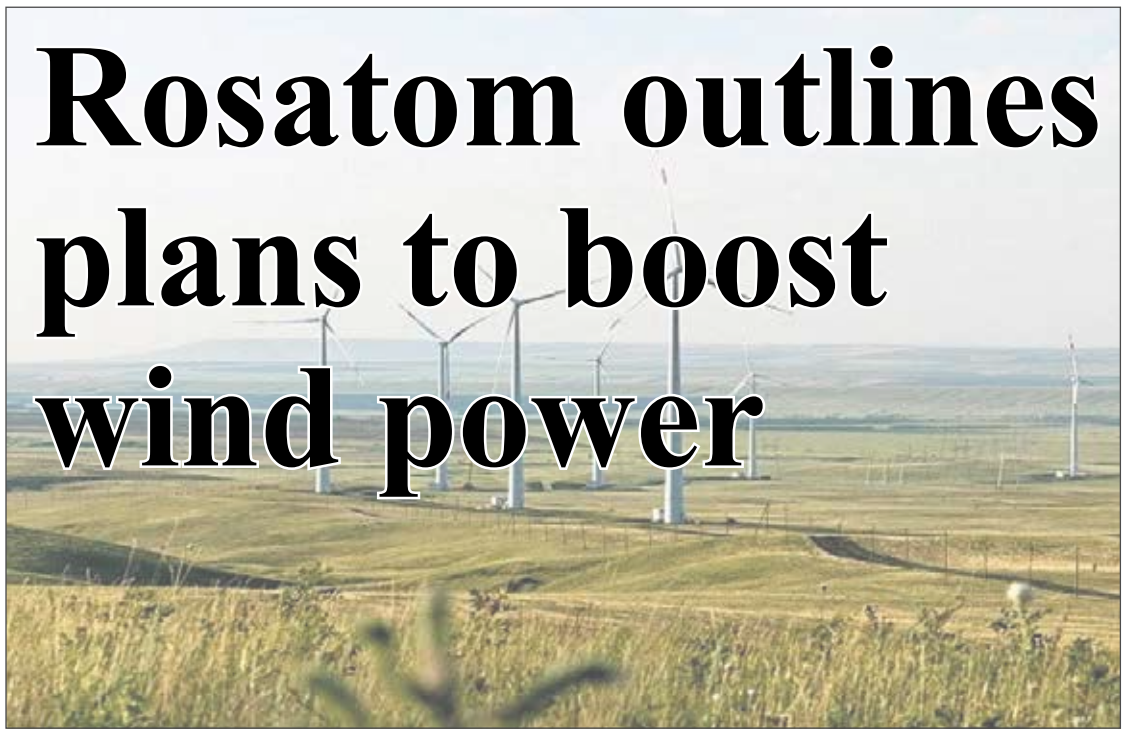
The UK's Nuclear Industry Association said more projects were needed to help decarbonise the grid. Tom Greatrex, Chief Executive of the NIA, said: "Nuclear power, in partnership with renewables, is essential to reaching net zero."

Advocates continue to press the case for nuclear even in countries with no history of the technology. In the Irish Republic, 18for0, a voluntary group of experts in energy and related fields, sent a preliminary study into nuclear development to Eamon Ryan, Minister for the Environment, Climate and Communications.

Ryan said recently that he would not 'rule out' nuclear power, but that questions remain and there are no active calls to examine its viability for Ireland.

Meanwhile, advanced nuclear energy developer Fermie Energia has plans to deploy the EU's first small modular reactor in Estonia by the 2030s. It recently said that northeastern Estonia's geology is suited for a deep borehole repository for spent nuclear fuel.

Rosatom outlines plans to boost wind power



- Aim to achieve 3 GW by 2030
- Supply chain boost planned

Russia's Rosatom has announced plans to increase its wind power capacity up to 3 GW – from the current 270 MW – by 2030, according to reports of a meeting in early February between the company's CEO, Alexei Lickhachev, and Prime Minister Mikhail Mishustin.

The state-owned energy corporation, a global leader in nuclear energy, set up wind generation division JSC NovaWind in 2017 to consolidate its wind power assets, and formed the Red Wind joint venture in 2017 with Dutch wind turbine manufacturer Lagerwey.

Gazprombank recently announced the closure of a financing deal for a 340 MW wind power plant to be commissioned by December 2022. Project company VetroSGC-2, owned by Rosatom, will receive 40 billion rubles ($540 million) over a 12-year period in exchange for a 49.5 per cent share in the company's capital. The deal brings Rosatom's capacity financed by the bank to 1 GW, for a value of over 100 billion rubles.

Rosatom said it was committed to sustainable development and in particular to maximising both wind generation and nuclear power – both electricity generation activities that produce low carbon emissions. First Deputy Director General, Kirill Komarov, said the deal with Gazprombank was "an excellent experience" that confirmed Rosatom's strategic approach.

Meanwhile, project company JSC WindSGC-2, part of JSC NovaWind, has obtained a permit to build the 60 MW Medvezhenskaya Wind Farm in the Stavropol Territory, which already hosts an operational wind farm and two under-construction projects.

"We plan to further increase the portfolio of orders in Russia, and enter international markets as a developer of renewable energy projects with Russian equipment," said Aleksandr Korchagin, CEO of NovaWind.

South Africa to speed up renewable energy procurement

President Ramaphosa's procurement drive seeks to make up for years of "disastrous" delays, writes **Nadia Weekes**

Large amounts of renewable energy will be procured through auctions in the coming weeks and months, South Africa President Cyril Ramaphosa said in his state of the nation address on February 11th.

Ambitious targets have been in place for years, but further procurement rounds were delayed since the fourth bid window ran in 2014. The delay has been described as "disastrous" by expert observers, amid repeated power shortages and warnings of more problems to come.

The Department of Mineral Resources and Energy is expected to be announcing shortly the successful bids for 2 GW of emergency power. Regulations have been amended to allow municipalities to buy power from independent power producers.

A request for proposals for 2.6 GW from wind and solar energy will be issued shortly as part of bid window 5, to be followed in August by procurement of an additional 11.8 GW in total, including 6.8 GW of wind and solar, 3 GW of gas and diesel, and 1.5 GW of coal power.

Additionally, the South African government has also proposed tenders for 500 MW of electricity storage, which are expected to be launched in September 2021.

According to state-owned utility Eskom, even with new generation coming online, the country would battle shortages of between 4 GW and 6 GW of capacity over the next five years as its ageing coal plants reach retirement age. A promised relaxation of licensing rules for new embedded generation projects could unlock up to 5 GW of additional capacity and reduce rolling blackouts.

Ramaphosa also pointed to the need to reduce Eskom's reliance on state hand-outs, including through a revision of tariffs to ensure that the utility recovers generation costs from municipalities. He promised a full review of South Africa's state-owned enterprises, with a new governance, financial management and operational performance framework due to be presented to parliament in the next financial year.

Eskom has already been restructured into three separate entities for generation, transmission and distribution. President Ramaphosa said this would lay the foundations for an efficient, modern and competitive energy system.

Ramaphosa said that Eskom will also be looking to partner with investors to repurpose and repower part of its coal fleet. "This will be done in a way that stimulates investment, local economic activity and local manufacturing, as part of a just transition," he said. Currently, three-quarters of electricity in South Africa is generated in coal power stations.

Middle East eyes first ever floating wind desalination facility

An innovative technology development could bring a floating offshore wind turbine to an undisclosed Middle East country as part of a seawater desalination project supplying drinking water to coastal regions.

Supported by a multi-partner European industry initiative, the Floating WINDdesal (FWD) turbine is designed to use extra-long blades and semi-submersible floating technology to access sea locations with greater water depths.

According to the project developers, the device's minimal impact on the maritime and terrestrial environment makes it ideally suited to emergencies and temporary missions. Because the unit can be easily relocated, it makes seawater desalination possible even in locations where conventional desalination could not be financed.

Banks help fund North African electricity transition

Funding packages are being activated to improve the stability and support the sustainability of electricity suppliers in North Africa.

The European Bank for Reconstruction and Development (EBRD) is providing €300 million ($361 million) to support Société Tunisienne de l'Electricité et du Gaz (STEG).

As well as supporting Tunisia's energy sector during the coronavirus pandemic, the package will allow STEG to implement an ambitious reform roadmap towards a more sustainable and efficiently run company, the bank said.

Tunisia relies heavily on gas imports from Algeria to meet its primary energy needs. In 2016, nearly 97 per cent of its electricity came from gas power plants. The country's energy policy encourages the development of renewable energy. However, Tunisia is currently unable to meet its full power demand.

The EBRD is supporting the decarbonisation of Tunisia's energy sector through support for solar and wind energy programmes. The newly announced financing package is accompanied by a detailed roadmap for corporate reform and energy sustainability. It includes grants from the European Union ($3 million), the Global Environment Facility ($1.44 million) and other donors.

The package consists of two facilities. The first is an immediate €100 million emergency stabilisation facility under the EBRD's Vital Infrastructure Support Programme. The second facility of up to €200 million will help refinance STEG's short and medium-term liabilities.

In addition, the European Union is providing an investment grant of up to €20 million to finance the implementation of an enterprise resource planning system, a necessary step towards the modernisation of STEG.

Meanwhile, the African Development Bank's Sustainable Energy Fund for Africa (SEFA) has pledged to support Morocco's Société d'Ingénierie Energétique (SIE) with a $965 000 grant that helps it transition into the first Super Energy Service Company (ESCO) initiative in Africa.

"This support from the African Development Bank will enable the operationalisation of the new SIE as a Super ESCO, thus creating a model well aligned with the needs of the country's energy efficiency sector," said Ahmed Baroudi, SIE's Chief Executive Officer.

Amid growing demand, Morocco aims to meet its energy needs by combining large-scale energy efficiency strategies and renewable energy investments. Super ESCOs are vehicles for channelling funds into public sector energy efficiency investments such as hospitals, schools, and street lighting, laying the foundation for subsequent private investment in the commercial and industrial sectors.

As a Super ESCO, it is hoped that the SIE will be able to overcome many of the challenges in scaling up energy efficiency investments. It should also open market opportunities for local ESCOs, offer quality assurance support and build their reputation among end-users and investors.

The grant will provide SIE with operational tools to develop a pipeline of bankable energy efficiency investment projects, said Brice Mikponhoue, Officer in Charge at the North Africa Regional Development and Business Delivery Office of the African Development Bank.

"The implementation of Super ESCOs on the continent will gradually contribute to the expansion and strengthening of the energy efficiency financing ecosystem," said Jalel Chabchoub, Chief Investment Officer and Energy Efficiency Specialist in the Department of Renewable Energy and Energy Efficiency at the African Development Bank.

"The African Development Bank is proud to support the first Super ESCO in Africa and looks forward to supporting further projects in the future," he added.

Competition hots up in offshore wind turbine market

- Vestas launches 15 MW turbine, reports 22 per cent jump in revenues
- GE expands Siemens Gamesa lawsuit

Junior Isles

Competition in the offshore wind turbine market escalated last month with Vestas' introduction of what will be the world's largest wind turbine, the V236-15.0 MW. The launch of the new offshore machine will provide an important boost to the company's drive to become the leading player in the global offshore wind sector.

The 236 m rotor diameter of the turbine takes it just ahead of Siemens Gamesa's 222 m rotor machine, which is rated at 14 MW with the ability to ramp it up to 15 MW. Vestas said serial production would start in 2024 with a prototype installed in 2022.

The launch comes nine months after Siemens Gamesa's turbine and sees the company playing catch-up with its main rivals. GE Renewable Energy launched its 12 MW Haliade-X offshore wind turbine in 2018. Vestas' largest existing offshore wind turbine has a rated output of 9.5 MW.

Despite trailing the competition, there are still a number of existing projects that Vestas could secure. The company said that its customers would be able to include the V236-15.0MW for their bids in offshore wind tenders this year.

Vestas' CEO Henrik Andersen added: "Offshore wind will play an integral role in the growth of wind energy, and the V236-15.0MW will be a driver in this development by lowering levelised cost of energy (LCOE), thus making our customers more competitive in offshore wind tenders."

He had previously said that a new offshore wind platform would be key to Vestas leading the market by 2025, following its acquisition of Mitsubishi Heavy Industries' stake in their joint venture.

The launch of the new turbine came as Vestas saw increased revenue in 2020, largely because of rising sales in North and South America, according to the company's annual report released in February.

The company's revenue stood at DKR110.2 billion ($18 billion) in 2020, an increase of 22 per cent compared to the previous year.

The North and South America region overtook Europe, the Middle East and Africa (EMEA region) as Vestas' largest revenue source in 2020 with DKR54.2 billion in revenue, a year-on-year increase of 39 per cent.

Meanwhile, Vestas' two main rivals are continuing to fight each other in the courts. General Electric filed a UK lawsuit against Siemens Gamesa on December 29th, to try to curb several of its contracts.

Last month the US company, to which Iberdrola has awarded the country's first offshore wind farm (Vineyard Wind), expanded the case it has already brought in the US with the International Trade Commission (ITC) concerning a patent for low-voltage driving in wind turbines.

GE acquired this patent from Enron Wind, which in turn obtained it through Zond during the consolidation of the US wind turbine market in the late 1990s. Since then, all GE competitors have been charged some kind of licensing fee, allowing the US giant to expand its leadership in the country's domestic market.

GE now intends to block the start of construction of at least two major UK projects in which Siemens Gamesa has achieved major supply contracts: the East Anglia Three and Hornsea Two projects. Together, these projects have an estimated investment of $7865 million and turbine supply contracts estimated at a total of $4718 million from Iberdrola and Ørsted.

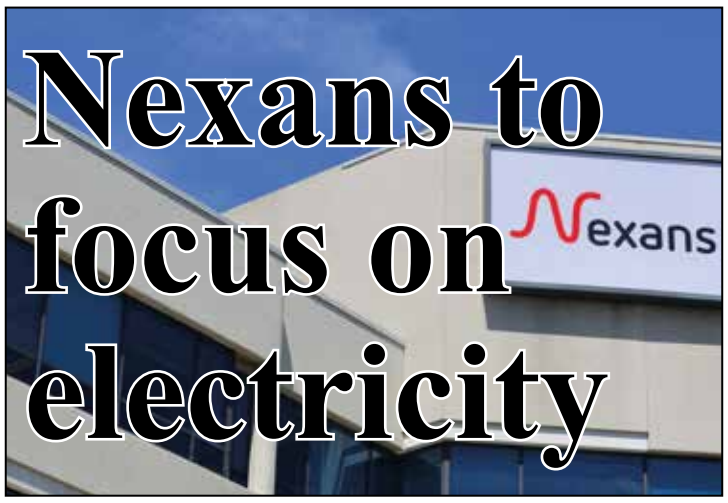
For its part, Siemens Gamesa has insisted that this demand will not affect the delivery of orders to its customers.

Siemens Gamesa expects to close sales of between €10.2 and €11.2 billion and a pre- PPA EBIT margin and integration and restructuring costs of between 3 per cent and 5 per cent by 2021.

■ Statkraft, Aker Offshore Wind and Aker Horizons have signed a cooperation agreement to explore the possibility to develop, operate and deliver power from commercial scale offshore wind projects the Norwegian Continental Shelf.

The three parties will investigate the opportunity for bottom-fixed offshore wind at the Sørlige Nordsjø II (SN2) offshore wind area, which the Norwegian government announced last year. The SN2 area could potentially be the site of the 1.2 GW Sønnavindar project, located in water depths ranging from 50 to 70 m. The partners are evaluating export possibilities to Europe and the UK and electrification of oil and gas assets for possible value-adding off-take.

Nexans to focus on electricity



Nexans has set out its strategy to transition from being a general cable manufacturer to become a pure electrification player in a move aimed at driving growth.

According to the company, the electrification market represents 65 per cent of the world cable market and is expected to grow by 4.3 per cent per annum over the next 10 years driven by growing energy consumption, demand for sustainable energies, grid modernisation and protection.

It said in a statement: "The world is becoming more electric and carbon neutral. Likewise, customer needs are changing from cables to systems and interconnected solutions." It added that "remaining a generalist will be more a weakness than a strength" and therefore "intends to become a pure electrification player.

Nexans says it plans to position all its operations across the electrification value chain – from the very start of production of energy, to transmission and distribution of energy, through to usage of energy. Notably, it will enhance its positioning in the offshore wind farms and interconnection markets through an additional investment of €200 million

The group will simplify its business model by moving from eight macro sectors, representing 34 subsectors, to four sectors, representing 12 subsectors. Nexans says it will therefore become a "fully integrated player covering the entire electrification value chain".

It said it will amplify and accelerate growth on electrification segments through transformative deals and bolt-on acquisitions, as well as programmes focused on innovation and partnerships.

In February, the company announced that it is also accelerating its own digital transformation through a partnership with Schneider Electric.

"Nexans has already embraced digitalisation in many areas of our business, using 3-D printing, big data and virtual reality," said Christopher Guérin, CEO of Nexans. "Now, the time is right to take our digital journey to the next level so that the benefits could be realised by all industrial assets worldwide."

Outlining its goals for the next three years, Nexans says that by 2024 it will generate €6-7 billion in sales as a pure electrification player. It also aims to return higher profitability, with EBITDA expected between 10-12 per cent of sales. The group says it will also rotate the remainder of its portfolio through divestments.

Hydrogen partnerships ramp up

- Acciona and Plug Power explore green hydrogen production for industrial and mobility sectors
- Engie and Equinor investigate blue hydrogen production at scale

Junior Isles

Several recent tie-ups between companies in the energy sector look set to accelerate the use of hydrogen in the global effort to cut carbon emissions.

In February Acciona, the Spanish-based supplier of sustainable infrastructure solutions, and Plug Power Inc., a global leader in hydrogen fuel cell systems and fuelling solutions, signed a memorandum of understanding (MOU) to launch a 50-50 joint-venture (JV) headquartered in Madrid.

The JV will be a leading green hydrogen platform serving clients in Spain and Portugal, providing cost-efficient and competitive green hydrogen to multiple end markets.

Plug Power will serve as the preferred supplier of electrolyser technology to the JV, with Acciona as the preferred clean electricity provider. The parties expect the JV will develop, operate, and maintain green hydrogen projects, serving the growing demand in the Iberian Peninsula.

The new company also plans to provide storage, transportation, and delivery services to its customers, initially targeting the industrial and the mobility business segments.

Similar efforts to produce blue hydrogen are also gaining traction. Engie and Equinor announced a partnership to develop joint low-carbon hydrogen activities. Specifically, the companies will investigate the production and market potential for hydrogen from natural gas whereby the carbon dioxide will be captured and stored permanently offshore.

Through a memorandum of understanding, they will investigate the development of low-carbon hydrogen value chains in Belgium, the Netherlands and France. Discussions with potential customers, stakeholders and relevant authorities are expected to start in the coming months.

Engie and Equinor believe that it is essential to develop low-carbon and renewable hydrogen projects at scale in order to make it possible for industrial customers to significantly reduce CO_2 emissions before 2030. This development of low carbon and renewable hydrogen will accelerate the construction of new hydrogen infrastructure and the repurposing of current natural gas infrastructure, thus paving the way for net zero in 2050.

These developments follow a move in early February by Uniper and Novatek, which signed an MoU to jointly investigate the potential for Novatek to supply both blue and green hydrogen to Uniper's power stations and markets in Russia and North West Europe.

Andreas Schierenbeck, CEO of Uniper, said: "Uniper is committed to turn the European generation business carbon neutral by 2035. Hydrogen will play a major role in achieving these goals. Germany, like many other heavily industrialised countries, will be dependent on hydrogen imports, as the demand for hydrogen exceeds production capacities. Therefore, we are seeking worldwide cooperation and partnerships. As an already trusted supplier of natural gas, Novatek is well prepared to develop export capabilities for hydrogen."

Americas

Siemens Energy to demo supercritical CO_2 turbine

Siemens Energy has signed an agreement with TC Energy of Canada to commission a novel waste heat-to-power pilot installation in Alberta. The facility will capture waste heat from a gas fired turbine operating at a pipeline compression station and convert it into electricity, which will be put into the grid.

As part of the agreement, Siemens Energy will build, own, and operate the facility, with the option for ownership to be transferred back to TC Energy. The patented technology is based on an advanced Rankine Cycle and uses supercritical CO_2 (sCO_2) as the working fluid. Because of its properties, sCO_2 can interact more directly with the heat source than water/steam, eliminating the need for a secondary thermal loop.

Benefits include a 25-40 per cent smaller footprint than steam-based systems, a 10 per cent increase in compressor station efficiency, and because the working fluid is contained within a closed-loop system, no boiler operator is required, making the system suitable for remote operation.

The pilot project is supported by $8 million in funding from Emissions Reduction Alberta's Industrial Efficiency Challenge. The new facility is scheduled to be commissioned by the end of 2022.

Colorado Springs orders six LM2500XPRESS GTs

Colorado Springs Utilities has awarded GE with an order for six LM2500XPRESS gas turbine packages to help it power the downtown area of Colorado Springs until a new transmission line is completed in 2025.

Colorado Springs Utilities has committed to retiring the coal fired Martin Drake Power Plant by the end of 2022. The LM2500XPRESS units will allow the uility to steadily reduce emissions by at least 80 per cent by 2030, from 2005 levels.

The 34 MW LM2500XPRESS units are the first of their kind to be installed in North America and are expected to start commercial operation by summer 2022.

Aram Benyamin, CEO of Colorado Springs Utilities, said: "The units were purchased to provide safe, affordable, and reliable generation to support the increased use of renewable solar and wind power. These natural gas units will help us better integrate renewable energy sources, further reduce CO_2 emissions, and accelerate the retirement of the Martin Drake Power Plant."

Wärtsilä energy storage for La Paz wind farm

A contract to provide an energy storage system for the 50 MW Eolica Coromuel (ECO) wind farm in La Paz, Mexico has been awarded to Wärtsilä. The energy storage system is designed to deliver 10 MW. Wärtsilä is also providing a long-term service agreement, including maintenance, spare parts, repairs, remote monitoring and performance guarantees.

ECO is owned by San Diego-based Eurus Energy America Corporation, the majority owner of which is the Tokyo-based Toyota Tsusho Corporation. Eurus Energy America Corporation is part of the Eurus Energy Group.

The energy storage system will be connected to the local grid operated by the National Centre for Energy Control (CENACE), Mexico's independent system operator.

Nick Henriksen, Vice President of Eurus Energy America, said: "This project will help Mexico meet its renewable energy goals, and efficient energy storage is a key element for its success. Mexico is to have 30 per cent of energy generated by 2021, and 35 per cent by 2024."

Calvert Cliffs NPP to get digital I&C upgrade

Framatome has signed a contract to upgrade a component of the instrumentation and control I(&C) system for the two units at Exelon's Calvert Cliffs Nuclear Power Plant in Maryland, USA. The new component, Framatome's digital control element drive control system (DCEDCS), provides simplified maintenance, streamlined system configuration, and overall operational reliability.

Framatome will provide design, fabrication, assembly, documentation, installation, and testing for the new DCEDCS at Calvert Cliffs Units 1 and 2. The upgrade also includes cybersecurity solutions from Framatome subsidiary FoxGuard Solutions and training simulator upgrades from Framatome subsidiary CORYS.

The 1800 MW Calvert Cliffs Nuclear Power Plant is located in Maryland, USA, and consists of two PWR units.

Asia-Pacific

CE&P vertical-axis wind turbine for Philippines

California Energy & Power (CE&P) has secured a contract to supply its vertical-axis wind turbines to engineering, procurement and construction (EPC) firm Hansei Corporation for projects in the Philippines.

Initially, turbines will be installed in strategic locations, with Hansei planning to deploy the turbines along a newly constructed expressway to power lighting systems, signalling/protection and electric vehicle charging stations.

The turbines will be combined with solar arrays for maximum power output in a small footprint. California Energy & Power is to begin shipping the turbines this year.

ONYX InSight to provide predictive maintenance

Eurus Energy has selected ONYX InSight to provide predictive maintenance services on 33 wind turbines at two wind farms in Japan – a total of 59 MW. The contract is for two years.

Under the terms of the contract, ONYX InSight will use its ecoCMS condition monitoring system to monitor drive train performance across the wind farms. This will be coupled with fleetMONITOR to analyse the performance and health data across the turbines.

Noah Myrent, Global Head of Monitoring, ONYX InSight, said: "By adopting predictive maintenance technologies, Eurus has positioned itself as a market leader in Japanese wind. Eurus will benefit from being one step ahead in an increasingly digital market, allowing the company to better manage operational budgets and improve turbine performance."

Europe

GE to build Europe's biggest onshore wind farm

German-based asset manager, Luxcara, has signed an agreement with GE Renewable Energy to develop the biggest onshore wind farm in Europe. The agreement includes a full turbine service and maintenance deal for 25 years.

The Önusberget onshore wind farm in Sweden will have a generating capacity of 753 MW. Luxcara has started infrastructure work, while GE Renewable Energy aims to start deploying the first of the 137 Cypress onshore wind turbines from July 2021. Each turbine has a capacity of 5.5 MW and a rotor of 158 m.

The turbine blades will include an ice mitigation system to ensure reduced downtime and a stable level of availability.

Hitachi ABB seals Dogger Bank transmission deal

Hitachi ABB Power Grids has won an order from the 3.6 GW Dogger Bank Wind Farm in the UK to connect the third transmission link from the world's largest offshore wind farm to the UK mainland, a distance of more than 130 km.

This contract extends the ongoing delivery of Dogger Bank A and B to include C1. The contract is subject to financial close of the third phase of Dogger Bank Wind Farm, currently scheduled for late 2021.

Dogger Bank Wind Farm is a 50-50 joint venture between SSE Renewables and Equinor. Hitachi ABB Power Grids will supply it HVDC Light technology, enabling electricity transmission and dynamic integration of the offshore wind farm to the onshore grid.

Niklas Persson, Managing Director of Hitachi ABB Power Grids' Grid Integration Business, said: "We are playing a key role in accelerating the energy transition. HVDC technology significantly contributes towards a carbon-neutral energy future by enabling the integration of large-scale and remote renewable energy generation."

EDF and Windvision land 226 MW French project

EDF Renewables and its Belgian partner Windvision secured a 226 MW project in France's latest tender for onshore wind turbine capacity in early February.

The Mont des Quatre Faux project will be located near Rethel, in the Ardennes department of France's Grand Est region. The power complex will cost around €250 million ($300 million). EDF said that the project was authorised last year by the Administrative Court of Chalons-en-Champagne, but it is currently being challenged in the administrative court of appeal. A final investment decision is expected in 2022.

Seven Nordex wind turbines for Italy

Enel Green Power, a subsidiary of Enel, has awarded the Nordex Group an order for seven N133 turbines for a wind farm in Italy. The turbines will be installed at a 30 MW wind farm in the Basilicata region in southern Italy. The contract also includes a service contract for the turbines for an initial two-year contract.

Construction of the wind farm is scheduled to start at the beginning of 2022, with completion shortly after.

East Anglia Hub to feature 14+MW turbines

ScottishPower Renewables has selected Siemens Gamesa as the preferred bidder to supply and install 14+MW wind turbines for its £6.5 billion East Anglian Hub offshore wind farm in the UK.

Over 200 14+MW wind turbines are planned for the East Anglian Hub, according to Iberdrola, parent company of ScottishPower Renewables. The two companies have agreed to work together ahead of the next Contracts for Difference auction – scheduled for later this year – to optimise the projects, with the ambition of then signing turbine supply and installation agreements.

Subject to the outcome of the planning considerations, construction of the East Anglia Hub is expected to commence in 2023, with completion in 2026.

The East Anglia Hub projects have the potential to deliver more than 7.5 per cent of the UK's 40 GW target for offshore wind generation by 2030 as set out in the government's Ten Point Plan. To deliver on the plan's ambitions, this year's Contracts for Difference auction will need to ensure sufficient deployment to put the UK on track to achieve this target.

International

Turkey orders $20 million transformer

Hitachi ABB Power Grids announced in February that it has received a $20 million order from TEİAŞ, the transmission system operator for electricity in Turkey. The order is to supply power transformers for a grid expansion project to bring power to remote regions across the country.

Under the contract, Hitachi ABB Power Grids' transformer business will supply 62.5 MVA and 100 MVA, 154 kV power transformers.

GE supports China coal-to-gas transition

GE has announced the start of commercial operation of Junliancheng Power Plant in Tianjin City, China. GE provided the power generation equipment for the new 661 MW CHP gas-fired power plant that replaced the coal-fired power plant. Following the transition, the Junliangcheng plant is expected to reduce SO_2 and NOx emissions by 1200 and 7775 tons per year, respectively.

The new plant, owned by China Huadian Tianjin Junliangcheng Power Generation, part of China Huadian Corporation (CHD), features the first commercially operating GE 9HA.01 technology in China. In addition to the 9HA.01 gas turbine, GE supplied the Mark* VIe Distributed Control Solution, for full combined cycle plant control and operation, while GE's local partner on this project - Harbin Electric - provided the steam turbine, generator and balance-of-plant equipment for Junliangcheng.

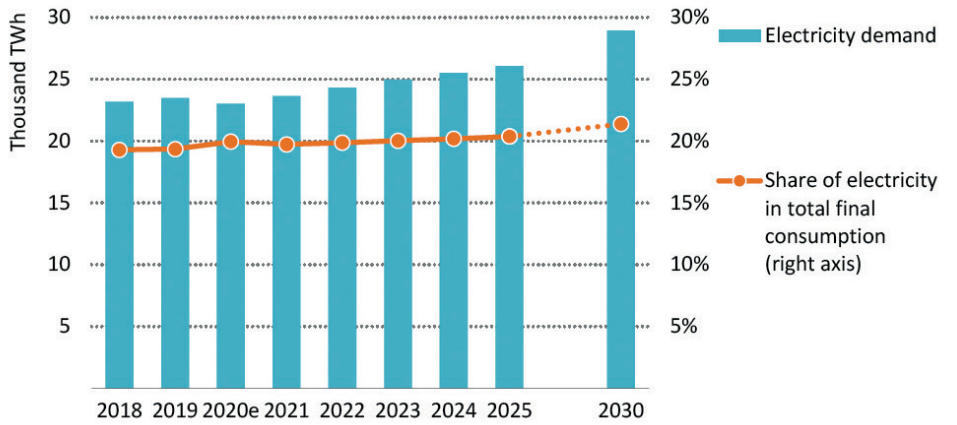
Senegal to build 300 MW CCGT plant

An order to supply gas power generation equipment for West African Energy's 300 MW combined cycle gas turbine (CCGT) power project in Cap des Biches, Dakar, Senegal has been awarded to GE. In a statement, GE said: "Upon completion, the Cap des Biches plant will be the biggest power plant in Senegal and is expected to generate nearly 25 per cent of the electricity consumed in the country.

The plant is expected to begin operations in phases starting in 2022.

GE will supply two 9E.03 gas turbines, one STF-A200 steam turbine, three A39 generators, two heat recovery steam generators, and additional balance-of-plant equipment as part of the project scope.

Global electricity demand and share of electricity in total final consumption in the Stated Policies Scenario

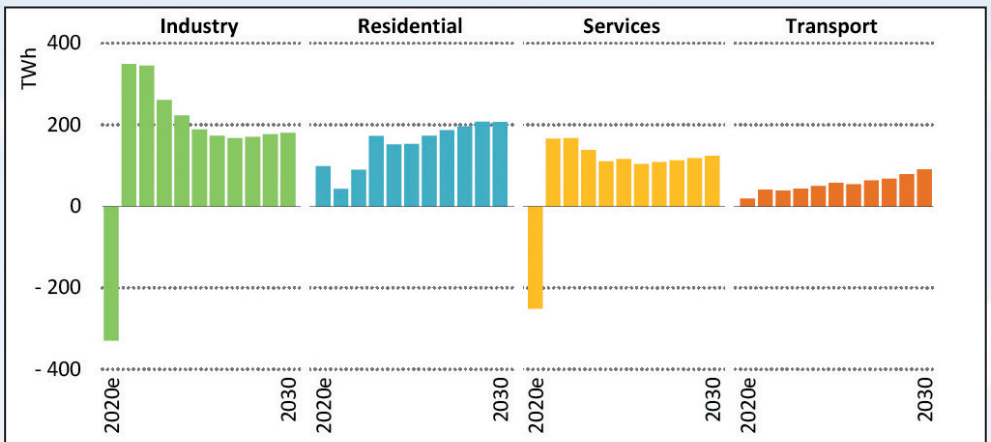


Electricity has proven to be more indispensable than ever during the Covid-19 pandemic, and meets an increasing share of energy demand growth as economies recover

Note: 2020e = estimated values for 2020.

World Energy Outlook 2020, © IEA/OECD, Figure 6.2, page 216

Annual change in global electricity demand by sector in the Stated Policies Scenario

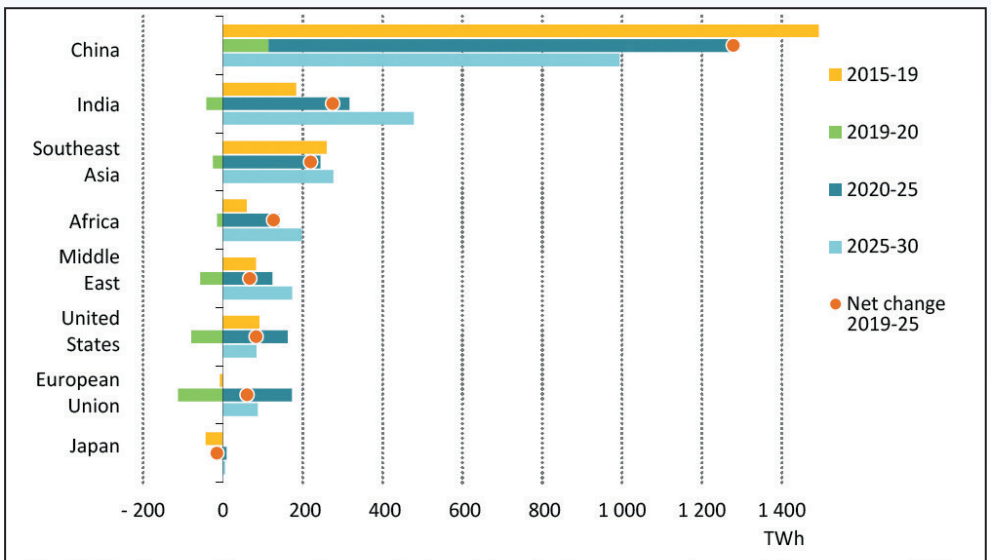


Demand in the industry and services sectors surges in the short term as economies recover, while higher incomes and electrification drive growth in electricity demand in the residential and transport sectors

Note: 2020e = estimated values for 2020.

World Energy Outlook 2020, © IEA/OECD, Figure 6.3, page 217

Changes in electricity demand in selected regions in the Stated Policies Scenario



Electricity demand in emerging market and developing economies rapidly surpasses 2019 levels, while the impact of Covid-19 on demand is longer lasting in advanced economies

Note: Changes in electricity demand from 2019 to 2020 are based on most recent monthly data where available and are a modelled result where not available.

World Energy Outlook 2020, © IEA/OECD, Figure 6.4, page 219

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Hydrogen

Energy companies team up to push green hydrogen forward

- Green Hydrogen Catapult initiative eyes 25 GW of electrolyser capacity
- HyDeal Ambition aims for hydrogen at €1.50/kg

Gary Lakes

The start of 2021 has witnessed a number of new moves by European energy companies that have them combining their efforts to push ahead with green hydrogen projects that will help put the European Union on track towards meeting its clean energy targets.

The EU in July 2020 launched its Hydrogen Strategy, which aims to see the installation of 6 GW of renewable (green) hydrogen electrolysers in the EU and the production of one million tons of green hydrogen by 2024. Currently, the EU has a capacity to produce only 0.1 per cent hydrogen that is green, but is keen to boost this in order to reduce emissions from the carbon-intensive steel industry, as well as those from heavy transport and chemical manufacture, which already uses fossil fuel-produced hydrogen and ammonia produced with fossil fuels.

The switch in energy systems is seen as not only a means of addressing climate change, but also as a way to encourage economic recovery in the wake of the Covid-19 pandemic. The EU will invest some €470 billion into green hydrogen production capacity by 2050 and €18 billion into low-carbon fossil fuel-based hydrogen, so-called blue hydrogen. By the end of this decade, the EU wants to see 40 GW of electrolysers installed throughout its member states. The programme involves the construction of renewable energy generation systems to produce green hydrogen, plus storage and transportation networks. In some cases, infrastructure currently used for transporting natural gas may be used to transport hydrogen.

It was announced in early February that a consortium comprised of 30 European energy companies had launched in Spain a project called HyDeal Ambition, which aims to deliver 100 per cent green hydrogen across Europe before 2030 at a price of €1.50/kg, which will make it competitive with fossil fuels.

HyDeal intends to use solar powered electrolysis from a base in Spain to initially meet green hydrogen markets in the Iberian Peninsula and southeastern France by 2022 and eventually the rest of France, Germany and other European markets.

The project calls for 95 GW of solar PV capacity and 67 GW of electrolysis capacity by the end of 2030. It will deliver 3.6 million tons of green hydrogen annually to the energy, industry and transport sectors through the gas transmission and storage network, which is included in the €1.50/kg price.

Partners in HyDeal include the gas transmission system operators of Spain, France, Germany and Italy and solar developers Falck Renewables, Qair and DH2/Dhamma Energy. Energy and industrial groups, electrolysis manufacturers, and financial institutions are also involved. The project "constitutes a complete industrial ecosystem, covering the entire green hydrogen value chain – upstream, midstream, downstream and finance – and is the result of two years of research, analysis, modelling, feasibility studies and contract design, aimed at enabling the production and supply of competitive green hydrogen in Europe," spokesman Thierry Lepercq said in a statement.

In December 2020, Spain's Iberdrola was one of seven major energy companies to announce the launch of the Green Hydrogen Catapult, which plans to produce green hydrogen at a price of less than $2.00/kg (€1.65/kg), near to the target price set by HyDeal.

The Green Hydrogen Catapult initiative intends to build 25 GW of electrolyser capacity by 2026 and aims to align the production and use of green hydrogen with a trajectory that displaces fossil fuels at a rate consistent with achieving net zero global emissions by 2050, the group said in a statement. The consortium includes ACWA Power, CWP Renewables, Envision, Ørsted, Snam, Yara and Iberdrola.

The group said that green hydrogen priced at $2.00/kg "represents a potential tipping point that will make green hydrogen and its derivative fuels the energy source of choice across multiple sectors – including steel and fertiliser production, power generation and long-range shipping."

February also saw the signing of a memorandum of understanding between Spain's renewable energy firm Acciona and Plug Power of the US for establishing a 50-50 joint venture that will produce green hydrogen for clients in Spain and Portugal for multiple market uses.

The JV will be located in Madrid and will over the next decade invest €2 billion in the development, operation and maintenance of green hydrogen projects. The JV aims to reach a market share target of 20 per cent of the green hydrogen industry in the two countries by 2030.

Meanwhile, France's Groupe Renault signed an MoU with Plug Power in January calling for the formation of a 50-50 joint venture based in France that will conduct research and development, transformation and manufacturing, as well as the sale of fuel cell-powered vehicles and hydrogen turnkey projects. The company will focus on light commercial vehicles, taxis and private automotive transport.

Gas

Qatar launches major LNG expansion with North Field East Project

Qatar Petroleum has taken the decision to proceed with the North Field East (NFE) Project, the largest LNG project ever undertaken. The project will help meet global gas demand, which is increasing as coal and petroleum are phased out.

Gary Lakes

Qatar Petroleum (QP) has positioned itself to dominate the global LNG market for the next 20 years with the launch of a $28.75 billion project to boost its LNG output by 33 million tons annually to 110 million tons per year by 2025.

QP is already the world's largest supplier of LNG with a capacity of 77 million tons per year, but in recent years it has come to see its role challenged by large projects in Australia and the US, which has seen an explosion of LNG export projects resulting from the boom in shale gas production.

Despite a market that has been volatile for some time and a future that remains uncertain despite recent gains, QP in early February took a final investment decision (FID) and announced that it would proceed with the North Field East (NFE) Project, the largest LNG project every undertaken. The state-owned company then proceeded to sign its main onshore engineering, procurement and construction (EPC) contract with Japan's Chiyoda Corporation and France's Technip Energies.

Qatar's natural gas exports and LNG industry are derived from the huge natural gas and condensate reservoir that exists beneath the Persian Gulf and which Qatar shares with Iran. In order to safeguard the integrity of reserves in the reservoir, Qatar declared a moratorium on further development in 2005 and that stayed in place until 2017.

The reservoir is the largest in the world and of important strategic value. The Paris-based International Energy Agency (IEA) estimates that the gas reservoir, which Qatar calls the North Field and Iran refers to as South Pars, holds 1800 trillion ft^3 (51 trillion m^3) of natural gas and 50 billion barrels of natural gas condensate. It covers an area of 9700 km^2, of which 3700 km^2 is in Iranian territorial waters, and 6000 km^2 lie in the Qatari offshore.

While some development has taken place offshore Qatar in recent years, the NFE project will concentrate on the eastern side of the field. When it is completed in the last quarter of 2025, the project will consist of four new mega-trains, each with a capacity to produce 8 million tons per year of LNG. The trains will be supplied with 6 billion ft^3/day of natural gas and also produce condensate, LPG, ethane, sulphur and helium. Total production will be the equivalent of about 1.4 million barrels of oil per day.

NFE is the first phase of expanded LNG production in Qatar. Another phase called North Field South (NFS) will increase Qatar Petroleum's LNG output to 126 million tons per year when it begins production in 2027. NFS will consist of another two mega-trains with capacities of 8 million tons per year each along with associated offshore and onshore infrastructure. A company statement said that QP may decide to expand its LNG operations further after 2027.

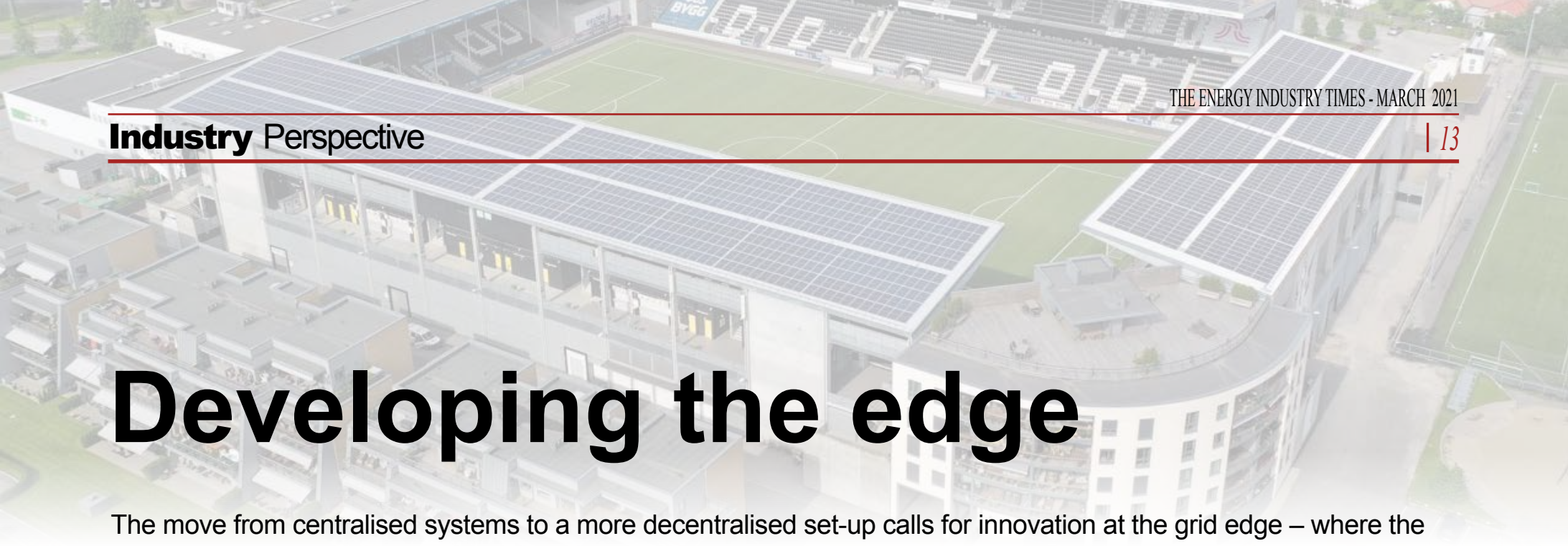
When announcing the project, QP was keen to point out that Qatar wants to supply clean energy to the world. Natural gas is the cleanest of the fossil fuels and is considered a bridge to an era of carbon-free sources of energy. The project includes a number of "concrete environmental investments in support of [QP's] strong commitment to achieve the highest environmental standards and provide a credible solution in the low-carbon transition", QP said in a statement.

Efforts are being made in numerous parts of the globe to phase-out the use of coal and petroleum and develop green fuels before 2050, but natural gas is expected to be in demand well into the future. NFE will include a CO_2 capture and sequestration (CCS) system that will be integrated with QP's existing system at Ras Laffan, and once it is operating, it will have the largest CCS capacity in the LNG industry.

QP will also draw power from an 800 MW solar plant currently under construction and build another 800 MW solar plant in the near future. By 2030, the company plans to have a solar power portfolio of 4 GW.

Moreover, a jetty boil-off gas recovery system will reduce greenhouse gas emissions (GHG) by a further 1 million tons annually. NFE will conserve 10.7 million m^3 of water per year by recovering 75 per cent of its tertiary water and the project is designed to reduce NOx emissions by 40 per cent.

As coal and petroleum are gradually phased out, demand for natural gas will increase. Qatar's LNG industry has already brought phenomenal wealth to the Gulf peninsula state, and the expansion of North Field production is expected to keep the money rolling in.



Developing the edge

The move from centralised systems to a more decentralised set-up calls for innovation at the grid edge – where the energy supply side, the grid, meets the demand side. **Junior Isles** speaks to Hitachi ABB Power Grid's Maxine Ghavi about what the key developments will be in the near to mid-term and the challenges that remain.

Grid edge is an evolving term but today, generally refers to the numerous technologies between the grid and the demand side. Driven by renewables and distributed energy resources (DERs), it is an area where, arguably, the greatest activity in the electricity sector is taking place.

Certainly all grid edge technologies are essential in realising the energy transition but there are three elements that are seen as key.

Maxine Ghavi, Head of Grid edge Solutions at Hitachi ABB Power Grids, commented: "In terms of specific technologies there are three key areas that we focus on and believe are key enablers of the grid edge. First, is power – battery storage, for example. Next is automation – for flexibility applications: how you optimise the asset; how you maximise its value; how you manage the different types and increasing number of DERs. And third, is digital: things such as data analytics and artificial intelligence, and applications, especially the cloud applications – these have an impact from a technology perspective and also have an impact on the economics of an asset and maximising its performance."

Ghavi: It's about the future being electric and this is finally being recognised

These three components not only help the grid operators and utilities to address the challenges they are seeing on the network as a result of more renewables and DERs, but also help them to maximise customer value, improve customer retention and create new business opportunities.

"As you bring on more renewables you need a much more flexible system, so flexibility is key. And as you bring on more assets, the next level is optimisation," she noted. "To have flexibility and optimisation, you cannot look at any single challenge in silo because you are now part of a much bigger network.

This means that as renewables and DERs grow, a much more complete view of the electricity system is needed. Ghavi explained: "Grid edge technologies can be what happens at the edge of the grid, what can happen behind the utility meter, or in front of the meter. But because of the way the transition is happening, what happens behind the meter can no longer stay behind the meter; what happens at the edge can no longer stay there, so there has to be a much more holistic view of looking at the grid infrastructure and the capabilities we need to enable."

While this does not call for a fundamental change in grid edge technologies in the near to medium term, Ghavi believes existing technologies will likely need to evolve and expand. "The physical assets layer is going to become more complicated. Today when we talk about electric vehicles, the penetration is still very small. And when you talk about energy storage and the global deployment of renewables, it's still small. But as those physical assets continue to build up, the challenges will increase. Plus you also have a growing number of prosumers at the residential and commercial/industrial levels making the system more dynamic," she said.

"So as this complexity increases, a more comprehensive approach to solving those problems becomes more necessary. The power, automation and digital capabilities not only help to address the challenges in the network but also help utilities and grid operators realise new business opportunities."

Looking at power specifically, Ghavi says the true value of grid edge technologies such as smart batteries, automation and energy management, however, is not necessarily recognised if each of the enablers are taken in isolation. It is when they are integrated that the new possibilities are realised.

Ghavi noted: "When solar was [first] deployed, it was about installing it for self-consumption, and selling excess back to the grid. That has evolved, especially when you bring storage into play."

She pointed to a project, which Hitachi ABB Power Grids executed in collaboration with Skagerak Energi at Skagerak Arena in Skien, Norway, as a good example of how grid edge technologies such as solar and smart batteries are being stacked to offer new possibilities. The arena is home to Odds football club, which initially had the idea to use the roof of its stadium "for something useful". The idea grew into a project that has seen the soccer club become the greenest soccer club in Europe.

As part of the 'Skagerak Energilab', the entire rooftop of the stadium was covered with 5700 m^2 of solar modules, with a nominal power of 800 kWp. An 800 kW/1MWh PowerStore battery and energy management system ensures maximum use of renewable power even when there is low light to power the stadium's floodlights. But the soccer club has gone further. It is combining its solar and storage technology with a microgrid to participate in the electricity market. And in addition to providing the neighbourhood with electricity, the project also allows Skagerak Energi to collect insights into how a prosumer system – where consumers both produce and consume electricity – operates under different conditions.

Ghavi added that the project is also set up to use EVs in vehicle-to-grid (V2G) applications. "It's about taking that value stacking to the next level," she said. With EV charging becoming more of a requirement, she also noted that this also has an impact on the electricity system's complexity and reliability.

"Utilities are evolving and looking at ways to retain customers by enabling services. But as the grid infrastructure becomes more complex, the expectation is that they still provide the same reliability and resiliency. This is where flexibility comes in," said Ghavi.

She cited the Energy Storage for Commercial Renewables Integration, South Australia (ESCRI-SA) Project, which the company executed for ElectraNet. Here the deployment of a PowerStore battery and e-mesh control system reduced outages from eight hours down to 30 minutes in the first six months of operation. It also improved network reliability, reduced renewables curtailment and lowered operating costs.

If utilities are to accelerate the deployment of these grid edge solutions, continued policy support will be crucial. Ghavi believes energy storage is a game-changer – even though it is no longer seen as a new component – and says that the recognition it is now beginning to receive from policymakers will be "really important".

She said: "Deregulation of electricity markets and increased penetration of variable renewables creates an environment that is prime for the accelerated deployment of storage. So there has to be enabling policies for both deregulation and renewables. There also has to be enabling policies that recognise storage as a network asset that utilities can deploy and leverage."

Although the approach to policy and the uptake of grid edge technologies varies from country to country, all are generally travelling in the same direction. "Some are moving faster than others," said Ghavi. "Part of that is due to their local dynamics and needs, and the challenges they are facing."

Using the UK as an example, she explained: "The UK is leading the way in the energy transition because if you look at the increased penetration of renewables, the UK is doing fantastic. And there is a deregulated electricity market. This has created a perfect environment where a lot of companies – whether technology companies, utilities or service providers – see the UK as a huge opportunity."

North America and Australia were cited as other examples where, although the dynamics and grid infrastructures are different, market deregulation and renewables are driving storage.

Looking forward, Ghavi said that while the energy sector will continue to build on existing solutions to address the challenges and opportunities of the energy transition, there will be further innovation in the grid edge space, especially in other sectors.

"If you look at the electrification of transport because of EVs, the electrification of industry driven by heating and process conversion, and the electrification of buildings, they will require additional innovation," said Ghavi. "There will also be additional innovation around energy optimisation and digital. It's about the future being electric and this is finally being recognised. And as these three sectors are electrified and converge, they will drive innovation in the overall power systems."

"There will also be innovation in storage media, where technologies that have been around for a long time could become economically viable in the mid- to long-term. But no matter what is deployed in terms of physical assets, things that we are working on – for example in our e-mesh portfolio and e-mesh applications – will still be relevant to technologies that are coming down the pipe."

More than a fleeting interest

Focusing on electrifying fleet vehicles holds the key to rapid decarbonisation of transport. **Junior Isles** explains.

Transportation accounts for 25 per cent of the EU-27's carbon emissions, second only to the electricity sector. It is therefore no wonder the European Commission sees the transport sector as central to achieving its aim to be carbon neutral by 2050.

To achieve its green deal target of cutting carbon emissions by 90 per cent by 2050, the European Commission says it will need almost all cars, vans, buses and heavy duty vehicles to be zero emissions by then.

The near-term aim is therefore to get 30 million zero emissions vehicles on EU roads by 2030, along with the installation of 1 million charging points by 2025 and 500 hydrogen fuelling points by 2030.

One of the fastest ways to accelerate the transition to an electric mobility (e-mobility) future and decarbonised transport sector is to scale electrification of fleet vehicles. Some 63 million vehicles are currently owned by fleets in the EU27 plus UK. And although this is only 20 per cent of the total number of vehicles – car, vans, buses and trucks – they represent 40 per cent of the kilometres driven and over 50 per cent of carbon emissions from all vehicles.

The question, however, is how to unlock this opportunity? This was the main topic of discussion at the recent online eVision conference organised by Eurelectric, the organisation that represents Europe's electric utilities. Eurelectric chose the event to introduce a major report produced in collaboration with EY that examines how to accelerate fleet electrification in Europe.

Bi-directional charging capability of fleet EVs not only supports long term climate goals but could also help deliver overall power system cost savings

The report, which includes feedback from European industry leaders across automotive, utilities, oil and gas, battery manufacturer, fleet management, leasing and charging infrastructure businesses, seeks not only to understand how to exploit this opportunity but also to assess the business case and how it can be aligned with climate interests.

Presenting the report's conclusions, Serge Colle, EY's Global Power and Utilities Leader, said: "If we are to reduce transportation emissions, it's very clear that we have to go after fleet first. If we can make [the decarbonisation of] fleets work it will be an incredible accelerator for the transition that we seek in transportation."

He also cited additional reasons for tackling fleet vehicles first. Fleet vehicles turnaround in typically 5-6 years compared to 10-12 years for the average consumer car. "This means that between now and 2030, in theory, we have the opportunity to turnaround the entire fleet two times, so there are two cycles still ahead of us."

Fleet vehicles also offer a better business case. As they do more kilometres, Colle argues that they will benefit more from the lower cost of ownership of EVs. "Low emission zones, for example will drive the different fleet owners to potentially switch faster. Fleet vehicles also have more predictable journeys. This means you can better plan for the needs of the new EV fleets.

The report identifies 11 different fleet types that each has its own characteristics in terms of vehicle type, driving patterns and economics that need to be accounted for.

"These go from the very easy to understand and easily addressable company cars to the other extreme – local transportation, which faces its own challenges in terms of range and vehicle types," noted Colle. "But the good news is, as we have been engaging with the different fleet owners to try to understand the various fleet types, there's a roadmap that we can build for every one of those segments which leads to acceleration of electrification of the fleet."

The report claims that about 60 per cent of the 63 million fleet vehicles are ready for acceleration to electrification. Still, challenges remain even with these fleets. It identifies five common problems that need to be addressed.

The first is the supply chain. Colle explained that the right type of vehicle has to be put in place. "There's work to be done to offer an even better experience. China offers a good example, where DiDi, their equivalent of Uber, is working with the car industry to build a 7-seater taxi vehicle that has no trunk and just one door at the kerbside. They are optimising the vehicle to offer better economics to the driver and a better experience for the passenger."

The second challenge is financing. Although significant green stimulus is available, penetration varies from country to country. The scope and how financing is deployed as stimulus, says Colle, is also not aligned with fleet. "Regulators are not really considering fleet separately. For example, onsite, on premise charging infrastructure is obviously one of the things that could be taken into account as well."

Infrastructure and the challenge of growing the number of charge points is seen as the third big challenge. Colle believes this is still "at the heart" of accelerating fleet and notes that there is no "fleet-centric deployment policy", if there is any policy at all. He said: "If you look at public charging points, it's haphazard. Either it's a private initiative or perhaps has happened because licensing is available at a certain point where there is high traffic density. It's not necessarily related to fleet requirements or big fleets around the country."

The digital interface is another key issue to be addressed. This is about putting the driver at the centre and providing a seamless experience as they visit various charging points. Portugal's EDP provides a good example. The utility has a specific lease platform, whereby it can optimise many of the challenges that a lease driver would encounter.

The fifth and final issue that needs to be addressed is regulation. There has to be cohesive regulation. The report notes that "a strong mandate for electrification will set a clear direction so that every participant in the value chain can engage in joined-up planning and investment".

There is a sound business case for fleet electrification. According to the report, about €350 billion per year is being spent on new fleet vehicles, with their annual fuel costs being €230 billion. Further, the market for fleet e-mobility services, including new services such as flexibility services, is worth some €120 billion by 2030.

As drivers' charging behaviour becomes better understood, and as the ability to forecast load becomes more sophisticated, network operators will make more informed investment decisions on future grid capacity. In turn, the EVs themselves will become part of a virtuous energy circle, providing short-term grid flexibility via smart charging vehicle-to-grid (V2G) energy exchange.

Smart charging will shift power demand to times of the day when renewable supply is high and power prices low. V2G goes one step further and enables the charged power to be pushed back to the grid to balance variations in energy production and consumption.

The e4Future project is one recent example of an initiative that aims to show what is possible. Launched in August last year it hopes to demonstrate how electric vans and cars can support the UK grid and provide a profitable and sustainable solution for business fleets.

As part of that work, in January Nissan, E.On Drive and Imperial College published a white paper that explores how the bi-directional charging capability of fleet EVs not only helps achieve the UK's long term climate goals but also could help deliver overall power systems cost savings of up to £885 million per year. It also reveals that annual fleet V2G charging benefits could range between £700-£1250 per vehicle.

Exploiting the synergies between the European power and transport sectors will help to unlock the commercial, environmental and societal value that e-mobility offers. The role of system operators, however, is critical in the rollout of charging infrastructure. They must ensure adequate grid capacity to accommodate the surge in drivers putting their EVs on charge at the end of the working day, without disrupting existing assets.

Speaking at the eVision conference, Adina Valean European Commissioner for Transport noted that the Commission also has to ensure that the electricity grid is "up to the task" of accommodating the number of EVs and charge points. She also said: "Obviously upgrading our infrastructure so that it is fit for a new era of mass market, zero emissions, mobility comes with a price tag. We are considering a budget of at least €1.2 billion for the first three years of the Connecting Europe Facility programme."

The EY/Eurelectric report calculates that installing the 3 million charging points that will be needed by 2030 will require €20 billion. It is a huge investment and an undertaking that calls for broad collaboration.

Distribution system operators (DSOs) will work alongside charge point operators to connect charging points to the grid. They will also work with e-mobility service providers, transmission system operators (TSOs), EV users, businesses and municipalities to make the grid smarter and able to utilise all the flexibility and storage options across the distribution network.

"Looking at the complexity and the enormity of the challenge – the need for a 10 per cent year-on-year reduction in CO_2 for the next 10 years – it can only be done if we build partnerships," said Colle.

If this can be achieved, says the EY/Eurelectric report, Europe stands "a very good chance" of meeting its 2030 greenhouse gas emissions target. The bloc is certainly on the right path – last year the EU passed China for the first time in terms of EVs sold. As Colle put it: "This might be the beginning of the real acceleration we are looking for."

Synthetic fuels in the fast lane

The Haru Oni project in Chile is gearing up to demonstrate the potential of synthetic fuel production from wind. Professor **Armin Schnettler**

Prof. Schnettler: facilities would tap into the vast under utilised potential for renewable energy

To achieve climate neutrality in Europe, a 90 per cent reduction in transport emissions is needed by 2050. To date, much of the focus has been on electrification, but the adoption of electric vehicles (EVs) still needs time as well as a fast expansion of the EV charging infrastructure.

The EU's ambitious carbon reduction targets will therefore require technologies to bridge the gap until electrification is mainstream. One of the most promising technologies to fill this gap is e-fuels. These are synthetic fuels produced with electric power from renewable energy sources, hydrogen, and carbon dioxide. The hydrogen is made from water via electrolysis, while the CO_2 can be taken directly from the air or unavoidable industrial sources. In the first step, hydrogen and CO_2 are converted into so-called e-methanol, which is then processed into e-fuel in another synthesis step.

One advantage that synthetic fuels have over electrification is that they can be used in existing petrol engines and be distributed through the existing filling station network. However, synthetic fuels are primarily produced from fossil sources such as oil and natural gas. If these fuels are synthesised from green hydrogen and carbon dioxide from the air or from unavoidable sources, sustainable fuel can be produced.

A vital step in this development is taking place with a demonstration project in Chile beginning the road to a methanol future. Siemens Energy's partners in this project are AME and ENAP from Chile, Enel from Italy, and Porsche.

Porsche has an obvious interest in the technology. It is not just meeting EU emission targets that make e-fuels attractive; synthetic fuels allow classic cars to be driven with little or no net CO_2 emissions. This is particularly important for prestige brands such as Porsche. About 70 per cent of all Porsche cars ever sold are still on the road, and with synthetic fuels these classic cars can be part of the solution to lower emissions.

The core of the project, known as Haru Oni, is located in the Magallanes Region south of mainland Chile. When operational in 2022 it will become the world's first completely integrated plant, producing almost climate-neutral e-fuel from wind energy. By 2026, it should be producing more than one million tons of e-methanol equivalent to over half a billion litres of e-gasoline per year. Because the production of e-fuels uses only renewable electricity and as the combustion of the e-fuel in the engine generates only as much CO_2 as was taken from the air during production, the entire production chain is almost CO_2 neutral.

This four-stage process of turning renewable energy into a synthetic fuel suitable for existing engines is complicated. Many have questioned the economic viability of such a strategy. Project lead at Siemens Energy Markus Speith explained: "The project's initial aim in Chile is to demonstrate the production process to show that this is a viable technology solution, we are planning to produce about 130 000 litres of e-fuel per year. It will also confirm that synthetic fuels produced here have an exceptionally low environmental impact. In the long term, we are planning larger projects with much higher production rates, and from our initial calculations, the costs look remarkably close to current fuel prices if there is a reduced tax on CO_2 neutral fuels."

Already the next phase of the project will be at an industrial scale, and this process is designed to be replicated to increase e-fuel output by at least a factor of ten for the next two phases planning for the mentioned 550 million litres of e-fuel in 2026. The hydrogen electrolyser is a module, where, like a battery, modules can be simply stacked to increase output. Conventional industrial scale methanol synthesis plants allow for such sizes already.

For the demonstration project, a 3.4 MW Siemens Gamesa wind turbine will be erected on the site. For phase two, the wind farm will be expanded to around 280 MW, and by the time it reaches an industrial scale, it will be 2.5 GW.

The Haru Oni project will initially use a Silyzer electrolyser to convert wind energy to hydrogen. Siemens Energy has developed the Silyzer portfolio family based on PEM technology. PEM takes its name from the proton exchange membrane, which is permeable to protons (H^+) but tight for gases and electrons. In other words, this kind of membrane acts as an electrical isolator between the anode and cathode side as well as a physical separator, preventing hydrogen and oxygen from remixing.

This method enables optimum efficiency at high power densities and good product gas quality even at partial loads. The operation is low-maintenance and reliable without the use of chemicals or other foreign substances.

Multiple basic systems can be combined into a PEM electrolysis network in a higher performance class. The scope includes an optional recooling system, water treatment system, power grid connection, and other associated equipment.

For the CO_2 that is combined with the green hydrogen to produce e-methanol, the project will use Global Thermostats (GT) direct air capture equipment. GT uses custom equipment and proprietary dry amine-based chemical sorbents that are bonded to porous, honeycomb ceramic monoliths that act together as carbon sponges. These carbon sponges efficiently adsorb CO_2 directly from the atmosphere. The captured CO_2 is then stripped off and collected using low-temperature steam (85-100°C), ideally sourced from residual or process heat at little or no cost – the output results in 98 per cent pure CO_2 at standard temperature and pressure. Only steam and electricity are consumed during the process, without the creation of emissions or other effluents.

This technology represents a breakthrough in the cost of Direct Air Capture (DAC), so that at industrial scale the Haru Oni project is expected to be economically viable. As with other technologies, costs are expected to continue to decrease through learning by doing, enabling DAC to play a prominent role in addressing the threat of climate change.

Although the pilot plant is making use of carbon captured directly from the air, there are other CO_2 sources termed as "unavoidable CO_2 emissions". Not all emissions resulting from industrial operations can be avoided but all unavoidable emissions can be compensated for and by using these in the production of e-fuels they are carbon free according to carbon calculations. This opens the opportunity of co-locating future e-fuel production facilities at industrial sites that currently emit CO_2.

Siemens Energy's technology involvement ends with the production of the green methanol, which is then passed to a methanol to gasoline (MTG) plant. This fluidised bed MTG technology licensed and supported by ExxonMobil is a cost-effective solution to convert methanol into fuels, which can be sold as-is or blended with ethanol, methanol, or petroleum refinery stocks. This minimises offsite and logistic complexity and investment for synthetic fuel distribution.

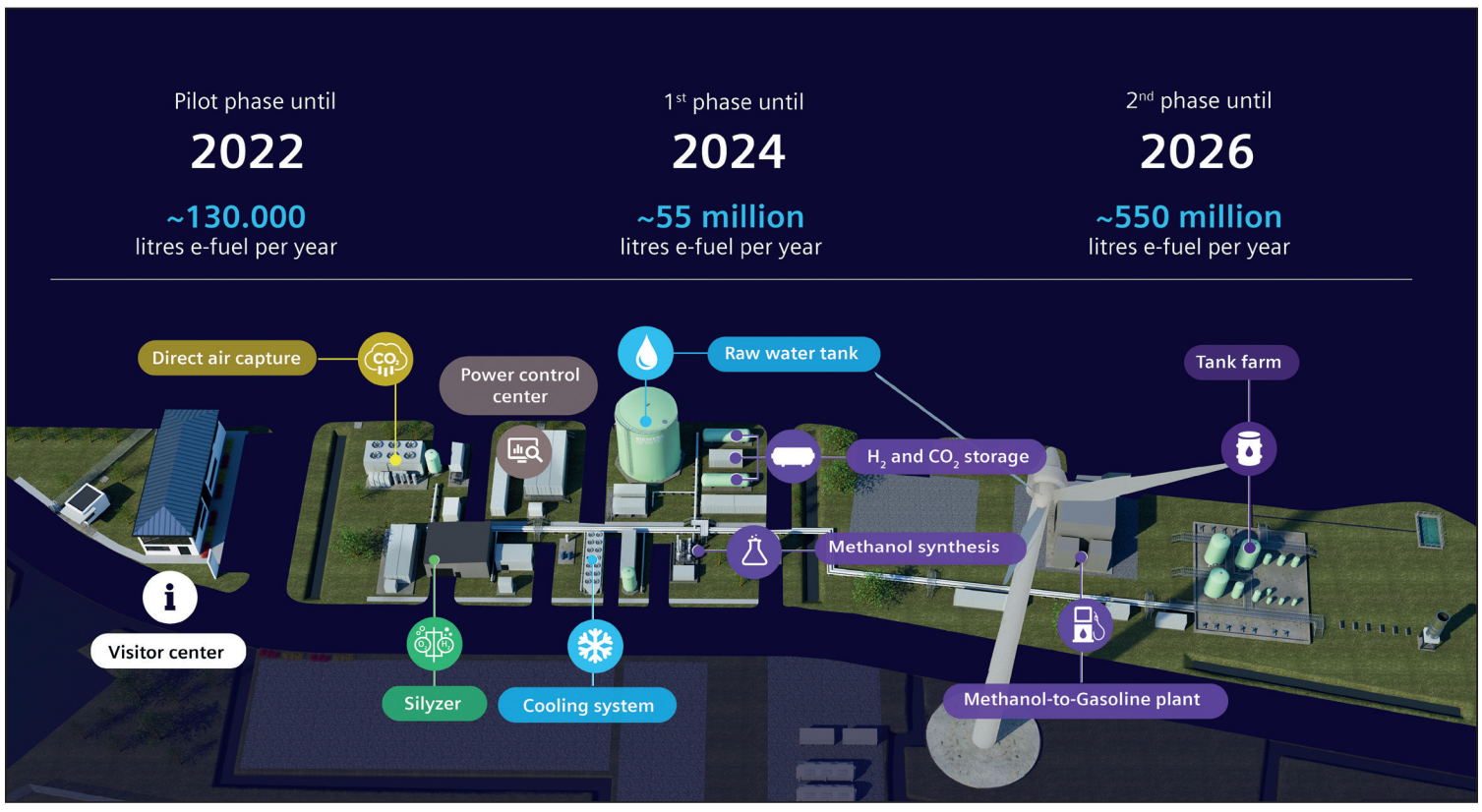
For Porsche, this demonstration project paves the way to fulfil the German automaker's low carbon strategy. Marcos Marques, Project Lead, at Porsche, explained: "Porsche is collaborating with worldwide partners to industrialise almost CO_2-neutral fuels. In the future, these are to be made available competitively in all markets. Our intention is not to replace e-mobility, but to flank it effectively. This applies to all those areas and markets where the transformation of the traffic sector is proceeding at a speed below the one required to reach the Paris climate targets."

While the project's location is not ideal in terms of executing construction because it is very remote, it was selected due to excellent wind conditions in terms of wind speed and availability. Also there is no other way to harvest this clean energy and move it to where it is needed.

For high wind locations in Europe, it is arguable that this would not be an efficient use of renewable energy when there are many other options available such as e-mobility. But in Chile, as with other remote regions of the world, there is a vast potential for wind energy that otherwise would not be harvested. It can easily be converted into hydrogen but transporting hydrogen over long distances is extremely expensive and challenging. That sparked the idea of transforming it into an e-fuel on-site to make it easy to transport by tankers. In the future, the tankers can run with e-methanol on a CO_2-neutral basis.

Once the technology is proven at an industrial scale and the economics validated, the pathway is open to building plants in various locations. These could be in South America, North America, the Middle East, Africa, or Australia. These facilities would tap into the vast under utilised potential for renewable energy, both wind and solar, to generate green e-fuel to decarbonise the automotive sector. But that is not all, the aviation sector is searching for a zero-carbon fuel, and aviation kerosene produced from green methanol is another intriguing and valuable application.

Prof. Armin Schnettler is EVP New Energy Business at Siemens Energy.



Overview of Haru Oni process. The project's initial aim is to demonstrate the production process to show that this is a viable technology solution

Junior Isles

Expect the unexpected

Cicero may not have had the foresight or cunning to avoid his beheading but energy companies, grid operators and certainly politicians around the world could still learn a thing or two from the Roman statesman. As Texans struggled to keep warm with no electricity last month, politicians were only too keen to play political football with the power outages that recently crippled the US state. But surely they must realise there is a bigger game at stake?

In mid-February a winter storm swept through the southern and southwestern US and parts of Mexico leaving millions without access to electricity, heat, and water. Despite rolling blackouts imposed by the Electricity Reliability Council of Texas (Ercot) and the Southwest Power Pool (SPP) grid operator, some residents of Texas went without power and heat for over 30 hours in sub-zero temperatures.

While observers from around the world may believe that "couldn't happen here", events in Texas demonstrate why preparedness now has to be taken to the next level.

The connection between Texas' nickname and its grid has not gone unnoticed when citing reasons for the catastrophe. The 'Lone Star' state, proud of its go-it-alone spirit, took the decision decades ago to remain isolated from the grids of other states so that it would not be under the jurisdiction of federal energy regulators. It is a decision that has now come back to bite. Not being able to wheel power in from across state lines, however, was only part of the problem.

Initially, fossil fuel lobbyists blamed renewables for the disaster. Dan Brouillette, an energy secretary under the Trump administration, said: "We've moved away from that to a more intermittent and frankly sometimes less reliable form of energy in the sense of wind and solar," Brouillette said on *Bloomberg Television*. "We've got to address this very squarely and have a very honest conversation about renewable energy in America."

Texas has the largest amount of installed wind power capacity in the US and, according to Ercot, some 16 GW was forced offline because of ice in the west and along the Gulf of Mexico coast. Ercot noted, however, that this figure exaggerates the amount of wind lost relative to expected output. In a seasonal resource assessment published in November, Ercot foresaw Texas wind farms operating at between 19 per cent and 43 per cent of rated capacity, providing 6.1 GW of power.

With Texas experiencing a shortfall of 45 GW out of a total 83 GW at the start of winter, singling out wind as the problem is a red herring. Dan Woodfin, Ercot's Senior Director of market operations noted that thermal power units, which run on natural gas, coal and nuclear fuel, accounted for slightly less than 30 GW of the capacity out of service.

In an interview with *Bloomberg*, Jason Bordoff, Founding Director of the Columbia Center on Global Energy Policy, pointed out that while it was true that wind output was down, it was also true that most of the lost electricity generation forcing outages came from gas and coal, because pipelines and valves were freezing along with coal piles.

In a separate interview with *CNN* he stressed that no single energy source was to blame. "The extreme cold is causing the entire system to freeze up," he said. "All sources of energy are underperforming in the extreme cold because they're not designed to handle these unusual conditions."

Clearly, all generating sources were impacted, and debating which energy source was at fault is a distraction from the bigger issue – are power companies and other critical infrastructure owners making adequate preparations for climate change?

Writing for *CNN*, atmospheric scientist Adam Sobel from Lamont-Doherty Earth Observatory noted that icy disasters such as this are often cited as evidence against the reality of climate change. While, he says that "the scientific consensus on human-induced global warming has never meant the permanent end of winter or of deadly cold snaps", he goes on to explain that scientists are still debating how climate change affects the frequency and severity of cold snaps.

Sobel describes one way that it could make them more common. He theorised that warming in the Arctic weakens the jet stream, making it wavier. "If the jet bends all the way to the Gulf of Mexico, it brings Arctic air with it in what is also called the polar vortex," he said.

Yutian Wu, an Associate Research Professor at Lamont-Doherty Earth Observatory, lends credence to such polar vortex phenomena. In 2019, she used climate modelling to show that decreases in sea ice in the Barents and Kara seas could weaken the jet stream, allowing frigid air to break out of the Arctic.

While scientists are still deciphering the relationships between climate change and cold snaps, one thing is clear: the increasing frequency and severity of heat waves, wildfires, hurricanes, and other extreme weather, will continue to stress electricity grids.

In the wake of the US outage, an investigation ordered by Texas Governor, Greg Abbott, is underway that will among other things look at how generators bolster their plants against extreme weather.

Woodfin said that winterisation practices put in place after a 2011 freeze would be reviewed. "We'll definitely go in and work with generation entities... and try to beef-up that plan to be able to handle what we understand to be more extreme weather," he said.

Cold weather kits common in more northerly states have historically not been necessary in Texas's warmer climate, and will come at a significant cost. Some kits can add about $150 000 to the cost of a turbine, said a banker involved in energy projects. Yet this pales against the economic cost of major blackouts, not to mention the cost of human lives.

US President Joe Biden could make use of the crisis to push for "historic investment" in the nation's grid, including better transmission systems and battery storage that would make the system more resilient amid extreme weather spurred by climate change.

The crisis should certainly give other nations pause for thought as the energy transition moves along at a pace that needs to be ahead of irreversible climate change.

All countries should note that an unreliable power system puts the energy transition at risk. Randy Bell, Director of the Global Energy Center and the Richard Morningstar Chair for Global Energy Security at the Atlantic Council, said: "Produce clean power, the thinking goes, electrify as much as possible, and we can cut out a large chunk of greenhouse gas emissions. But if the grid is not reliable and resilient... one wonders how many people will actually choose electric vehicles, electric heat, and electric cooking."

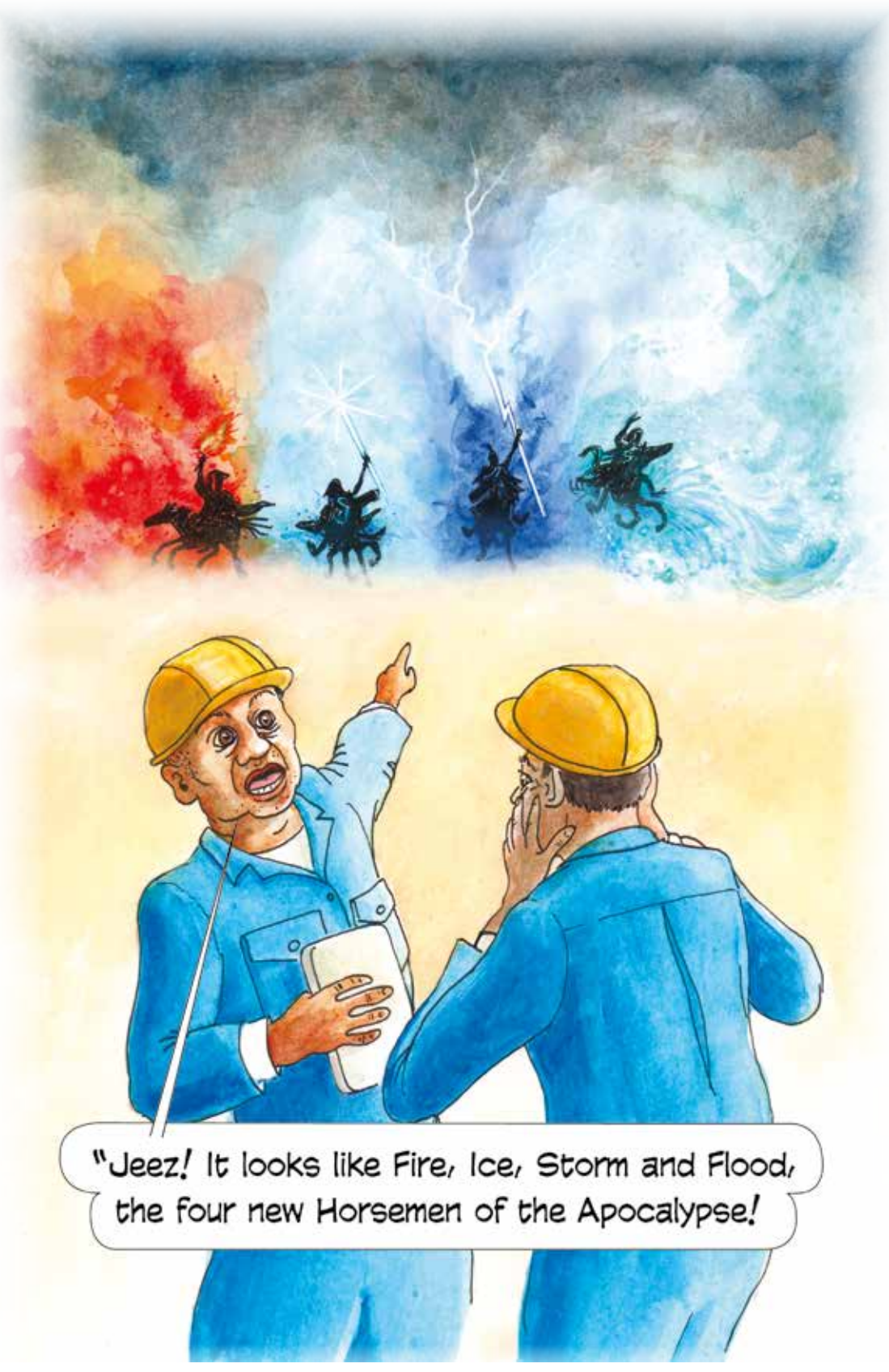
The World Energy Council's 2020 *Issues Monitor* – a survey of over 3000 responses from energy leaders in 104 countries as well as 550 responses from individual energy users in 50 countries – identified the major trends and topics impacting the energy transition. It found that although the climate framework issue receives priority attention in all countries, uncertainty remains around the impact of intensifying extreme weather events and the need to adopt climate adaptation and mitigation measures.

Countries with greater exposure to extreme weather events show more concern about the pace of climate but there has to be wider concern over the pace of collective global actions.

Texas should be a lesson to owners and operators of critical infrastructure all over the world. It is no longer sufficient to describe events in California and Texas as "unprecedented" and expect that to be sufficient to placate citizens left freezing in the dark. It is time for utilities to adjust their models to account for new precedents.

Moreover, politicians must stop using energy policy to score goals. As Cicero once said: "Let us not go over old ground. Let us rather prepare for what is to come." Building resilience is key. Be prepared for extremes.

As Oscar Wilde put it: "To expect the unexpected shows a thoroughly modern intellect."



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