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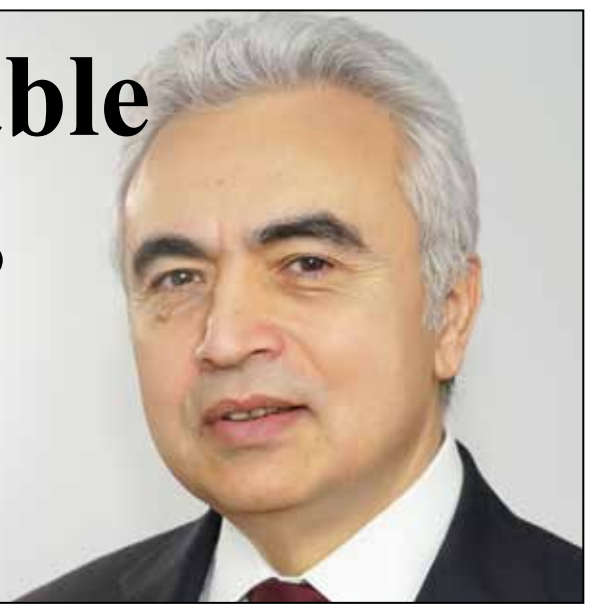


Dr Birol: energy investments now face unprecedented uncertainties

The findings of the World Energy Investment 2019 report signal a growing mismatch between current trends and the paths to meeting the Paris Agreement and other sustainable development goals.

Junior Isles

The 'World Energy Investment 2019', recently published by the International Energy Agency, claims that the levelling off of investment in renewables and energy efficiency represents a serious threat to efforts to meet the targets set out in the Paris climate change agreement and United Nations Sustainable Development Goals (SDG).

Following three years of decline, global energy investment totalled more than $1.8 trillion in 2018, a level similar to 2017. Still, even as investments stabilised, approvals for new conventional oil and gas projects fell short of what would be needed to meet continued robust growth in global energy demand, said the report. At the same time, there are few signs of the substantial reallocation of capital towards energy efficiency and cleaner supply sources that is needed to bring investments in line with the Paris Agreement and other sustainable development goals.

Launching the report, Mike Waldron, Head of the IEA's investment team, explained: "A lot of this decrease in renewables investment was due to a stable picture for net additions, as well as falling costs. A lot of it is attributed to China but renewables investment in the rest of the world actually increased in 2018."

Last year, however, was the first time since 2001 that growth in renewable power capacity failed to increase year on year. New net capacity from solar PV, wind, hydro, bioenergy, and other renewable power sources increased by 177 GW in 2018, the same as the previous year. This, says the IEA, is only around 60 per cent of the net additions needed each year to meet long-term climate goals.

According to the IEA's Sustainable Development Scenario (SDS), spending on renewable power needs to double by 2030 as the world should be installing over 300 GW annually on average in the 2018-2030 period, if it intends to reach the goals of the Paris Agreement. The IEA warned that the carbon dioxide (CO_2) emissions produced by the energy sector increased by 1.7 per cent to 33 Gt, despite a 7 per ent growth in the electricity production from renewables.

"Energy investments now face unprecedented uncertainties, with shifts in markets, policies and technologies," said Dr Fatih Birol, the IEA's Executive Director. "But the bottom line is that the world is not investing enough in traditional elements of supply to maintain today's consumption

Continued on Page 2

Iran nuclear programme again in focus as US tensions escalate

The administration of US President Donald Trump is renewing three key waivers that allow European allies, China and Russia to cooperate with Iran on civil nuclear programmes.

The projects include reactor redesigns to prevent the creation of plutonium and infrastructure projects that will help ensure that some facilities are not used for uranium enrichment.

"Iran must stop all proliferation-sensitive activities, including uranium enrichment, and we will not accept actions that support the continuation of such enrichment," the US State Department said in a statement.

The administration will renew the waivers for Iran's Fordow, Bushehr and Arak nuclear facilities for 90 days, with the potential for them to be renewed. This is instead of the 180 days the original waivers were for. The waivers, which were due for renewal May 5, allow countries to help Iran convert its nuclear facilities to non-military purposes in line with a 2015 nuclear accord.

Fordow, which was originally an underground uranium enrichment facility, is being converted into a nuclear physics and technology centre under the terms of the accord.

Arak is the site of an unfinished heavy water reactor Iran was building before the deal. Iran destroyed the heart of the reactor as part of the deal, and now China and the United Kingdom are overseeing work on a replacement reactor for non-weapons grade plutonium.

Bushehr is a civil nuclear reactor that is fuelled by Russia, which has been ensuring the spent fuel does not pose a proliferation risk.

The waivers for civil nuclear cooperation were first granted in November when the administration re-imposed all the sanctions that had been lifted under the Obama-era Iran nuclear deal.

The US introduced the measures as a continuation of previous policies aimed at curbing Iran's ability to revive its nuclear weapons programme. Two other waivers, one that allowed Iran to ship surplus heavy water to Oman and another that allowed Russia to process Iranian uranium, will be revoked.

Among the policies are an oversight of the country's civil nuclear programme, which the department said would constrain Iran's ability to shorten its "breakout time" in terms of getting a nuclear weapon.

The department introduced further restrictions on Iran including sanctions on the transfer of enriched uranium out of Iran in exchange for natural uranium and warned that any assistance to expand Iran's Bushehr nuclear power plant beyond the existing reactor unit could be subject to sanctions.

US nuclear sanctions will remain in place to help maintain the nuclear status quo in Iran until a comprehensive deal resolving Iran's proliferation threats is in place to replace the 2015 agreement that has been rejected by President Trump.

Trump pulled the US out of the earlier agreement amid criticism that the accord was hampered by limited international inspection requirements while allowing the nation to resume past nuclear weapons work in 10 to 15 years.

On May 9, Iran responded saying it is pulling out of "some commitments" made under the nuclear deal, and will resume higher enrichment of uranium in 60 days unless a new agreement can be reached.

President Hassan Rouhani said: "We are ready to negotiate, within the boundaries of JCPOA," referring to the Joint Comprehensive Plan of Action nuclear deal. "It is not us who has left the negotiation table."

Continued from Page 1

patterns, nor is it investing enough in cleaner energy technologies to change course. Whichever way you look, we are storing up risks for the future."

"The world cannot afford to press 'pause' on the expansion of renewables and governments need to act quickly to correct this situation and enable a faster flow of new projects," said Dr Birol.

To meet sustainability goals, investment in energy efficiency, which has stalled over the last two years, would need to accelerate.

The IEA also said that even though decisions to invest in coal fired power plants declined to their lowest level this century and retirements rose, the global coal power fleet continued to expand, particularly in developing Asian countries.

Waldron said: "The continuing investments in coal plants, which have a long lifecycle, appear to be aimed at filling a growing gap between soaring demand for power and a levelling off of expected generation from low-carbon investments (renewables and nuclear).

"Without carbon capture technology or incentives for earlier retirements, coal power and the high CO_2 emissions it produces could remain part of the global energy system for many years to come."

He said that by 2030 under the SDS, most if not all coal fired plant would have to be equipped with capture. "We're within a matter of single digit years in which such investment decisions would need to turn," he noted.

Gould: investment is "well short of requirements

Summing up the findings from WEI 2019, Tim Gould, who heads the Energy Supply and Investment Outlooks division at the IEA, noted that investment is "well short" of what is required to meet the UN's SDG.

"The share of low carbon investment – renewables, nuclear, efficiency, batteries, carbon capture utilisation and storage – has been stuck at around one third of the total [energy investment] for the last few years. We would need to see that share going up to around two thirds over the next decade in order to put us on the trajectory consistent with the Sustainable Development Goals."

In a separate report issued shortly after WEI 2019, the IEA stated that despite significant progress in recent years, the world is falling short of meeting the global energy targets set in the SDG for 2030. The organisation's 'Tracking SDG7: The Energy Progress Report' says that ensuring affordable, reliable, sustainable and modern energy for all by 2030 remains possible but will require more sustained efforts.

The report also shows that great efforts have been made to deploy renewable energy technology for electricity generation and to improve energy efficiency across the world. Nonetheless, access to clean cooking solutions and the use of renewable energy in heat generation and transport are still lagging far behind the goals.

See page 11 for WEI 2019 data.

Vision 2020+ could see Siemens exit power sector

The struggling market for large gas turbines, which has already caused a massive shakeup at GE, has now prompted Siemens to take steps to spin-off its gas and power division.

Junior Isles

Siemens is looking to exit the power sector and increasingly focus on digital industries and smart infrastructure in the face of falling demand for power plant equipment.

Under its Vision 2020+ strategy the German industrial giant plans to spin-off its struggling gas and power unit, then sell its majority stake in a public listing scheduled for September 2020. It will then concentrate on higher-margin businesses, such as connecting industries to the internet.

The division to be carved out comprises its oil and gas, conventional power generation, power transmission and related services businesses.

Siemens' Gas and Power (GP) unit is to be "given complete independence and entrepreneurial freedom through a carve-out and a subsequent public listing", Siemens said in a statement.

Joe Kaeser, Siemens' Chief Executive, said he believed the conglomerate structure should be a thing of the past. He told investors that the answer no longer lay in being big, otherwise "the whole world today would be full of dinosaurs".

He added: "They've [the dinosaurs] been the biggest. But something must have been wrong with them because, obviously, they don't exist. What was wrong with them was not their size, but the lack of adapting to different conditions that history provided for them."

The company said the restructuring would see it cut 10 400 jobs, but it expected to create 20 500 more through growth through 2023, leading to a net increase of 10 000.

With 44 000 employees, the gas and power unit booked sales worth €12.4 billion in 2018 – the same as 2014. Profits over that period, however, plummeted from €2.2 billion to €377 million as the industry struggled with gas turbine overcapacity due to the global shift from fossil fuels to renewable energy.

Chief Operating Officer for the division Tim Holt said the industry had capacity to build 400 gas turbines a year, but global orders were fewer than 80. This led to prices being depressed, impacting all the big gas turbine manufacturers. GE Power has dragged down GE's bottom line results over the past two years and led to major layoffs and changes in the executive ranks.

Though Siemens still operates eight divisions, the "new" Siemens will place its focus on just two areas – Smart Infrastructure, which connects infrastructure to the internet, and Digital Industries, which enhances manufacturing with digital tools. These two sectors have been set new profit margin targets of 10-15 per cent and 17-23 per cent.

Siemens will still hold large stakes in four "strategic" companies – Siemens Gamesa Renewable Energy (SGRE), medical technology unit Healthineers, the transport technology arm Mobility and the traditional energy Gas and Power unit. But these groups will operate independently.

The decision to divest entirely will be left to Kaeser's successor after his contract expires in 2021.

Lisa Davis, Chief Executive of Siemens' gas and power division, told investors that the new spin-off will be able to market itself as a €30 billion business volume company capable of delivering any sort of electricity need, because of its controlling stake in SGRE.

In its latest results posting, SGRE reported that revenue increased by 6 per cent year-on-year in the first half of FY 2019, to €4651 million and by 7 per cent in the second quarter, to €2389 million, supported by strong performance in Offshore and Service. On the back of the results, SGRE became the first wind turbine manufacturer to attain an investment grade rating.

EU says one size does not fit all on cyber security

In a Legal Update on its recommendations on cyber security in the energy sector, the EU Commission has said that companies should not rely on a "one-size-fits-all" approach for the security of their products. They should instead split the overall systems into logical zones and apply appropriate measures to each of them.

This Legal Update gives a refresher on the EU cyber security framework for the energy sector and provides a summary of the EU Commission Recommendations, including next steps that energy network operators should consider.

In April the EU institutions (i.e., the European Parliament, the Council and the EU Commission) reached an agreement on the Cyber security Act. The act creates EU cyber security certification schemes for information communications technology (ICT) products; services (involved in transmitting, storing, retrieving or processing information via network and information systems); and processes (activities performed to design, develop, deliver and maintain ICT products and services). The new framework is designed to give companies operating in the energy sector an opportunity to certify their products, services or processes.

The EU Commission also proposed sector specific legislation under the 'Clean Energy for All Europeans' package, which has cyber security aspects. The new 'Regulation on Risk Preparedness of the Electricity Sector' requires EU member states to develop national risk preparedness plans that take into account cyber security and guarantee the stability of their systems against potential threats.

Member states are expected to take steps to follow the EU Commission Recommendations when developing national cyber security frameworks (e.g., through strategies, laws, or regulations). Within the next 12 months and every two years thereafter, EU member states are required to communicate to the EU Commission details about the state of the implementation.

The war on cyber attacks received a recent boost with the announcement of a new partnership between Siemens and Chronicle, an Alphabet company, to protect the energy industry's critical infrastructure.

Through a unified approach that will leverage Chronicle's Backstory platform and Siemens' strength in industrial cyber security, the combined offering is claimed to give energy companies "unparalleled visibility" across information technology (IT) and operational technology (OT) to provide operational insights and confidentially act on threats.

The partnership will help companies securely and cost-effectively leverage the cloud to store and categorise data, while applying analytics, artificial intelligence, and machine learning to OT systems that can identify patterns, anomalies, and cyber threats. Chronicle's Backstory, a global security telemetry platform for investigation and threat hunting, will be the backbone of Siemens' managed service for industrial cyber monitoring, included in both hybrid and cloud environments.

UK can achieve net zero ambitions but at what cost?

Experts believe the UK can achieve its recently announced target for net zero carbon emissions by 2050. The question is at what cost?

At the end of April, the Committee on Climate Change (CCC) issued a report advocating that there was a sound scientific, technological and legal case for the adoption of a new, legal net-zero emissions target by 2050 at the very latest.

While many welcomed the report, there is a big question mark as to what it will cost.

Michael Wheeler, Executive Director, UK Energy, Ramboll, said: "Achieving a net zero target is possible, but the cost of doing so is still uncertain – with many technologies still in development, we aren't able to provide cost certainty for many potential solutions to all our energy usage problems. There is also some uncertainty as to what will be the size of the energy market as we become more energy efficient and what may be the impact of changes in other sectors."

He also noted that achieving net zero will be heavily influenced by whether new nuclear will be economically viable. "If it is not included in the mix, then the source of firm reliable energy will need to come from energy storage methods to counter the intermittent energy supply associated with renewable technologies, such as solar or wind power.

"The present alternatives to nuclear and energy storage for achieving zero emission 'firm' capacity include biomass fired projects and gas fired CCGT incorporating carbon capture and storage (CCS), however these do not currently receive government subsidy (in today's energy market all forms of firm capacity power generation and storage need some form of subsidy to be viable)."

Just ahead of the CCC report, a select committee of MPs said the UK cannot "credibly" reduce greenhouse gas emissions to net zero without the widespread use of carbon capture but government support for the fledgling industry has been "turbulent".

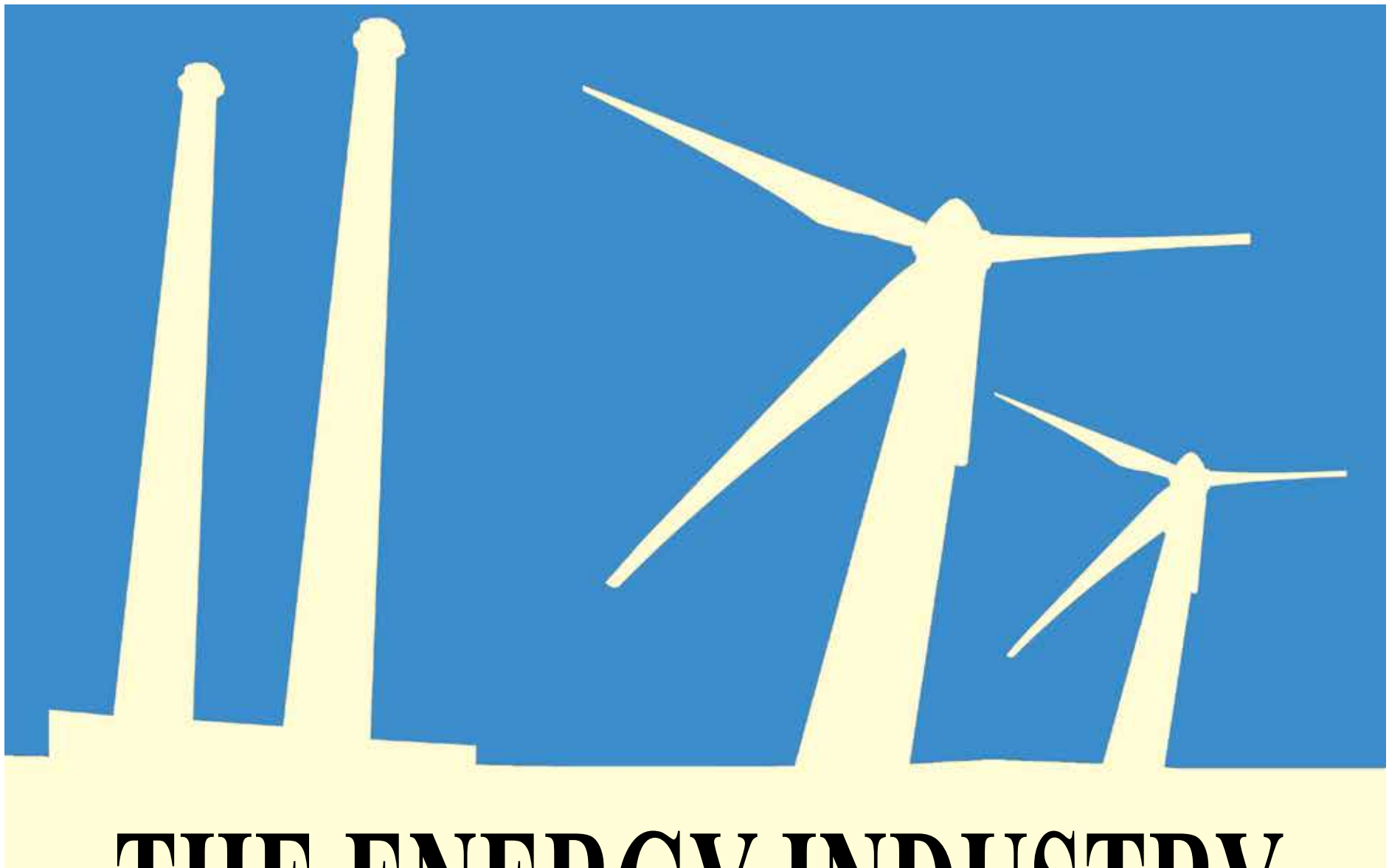
The UK has yet to develop a commercial-scale project. Government subsidy auctions, in 2007 and 2012, to develop projects were later cancelled amid concerns over costs.

The government maintains it aims to have "the option to deploy CCUS at scale during the 2030s, subject to costs coming down sufficiently". However, the business, energy and industrial strategy select committee report said this did not indicate a commitment commensurate "with the importance of this technology".

In 2012, it was estimated that proposed power plants with carbon capture schemes would require government subsidy contracts with a "strike price" of £170/MWh. More recent projections have reduced to £80-90/MWh, although this is still more expensive than offshore wind.

The CCC report says the UK will need 75 GW of operating offshore wind capacity to reach net-zero greenhouse gas emissions target by 2050.

Matthew Wright, MD at Ørsted UK, commented: "75 GW of offshore wind by 2050 is definitely achievable. The cost of offshore wind has already reduced to the point where it is comparable with conventional generation, and it's continuing to fall."



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Halt on US Clean Power Plan may have wider implications

Renewables show fastest growth but shale is here to stay

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Brayton Point set for key role in offshore wind

■ Battery, HVDC link at former coal plant ■ $640 million investment inked with Anbaric

Siân Crampsie

A former coal fired power plant site in Massachusetts is set to become a central focus of the USA's growing offshore wind energy sector, its owner says.

Commercial Development Company (CDC) has signed an agreement with transmission experts Anbaric to transform the Brayton Point site into a renewable energy centre featuring HVDC transmission facilities and energy storage capacity.

The agreement is part of CDC's vision of transforming the former coal fired power plant site into a world-class logistics port, manufacturing hub and support centre for the offshore wind energy sector in northeast USA, where up to 18 GW of offshore capacity could be added by 2035.

The Anbaric Renewable Energy Center would include a 1200 MW, $250 million HVDC converter to connect offshore wind farms to the US grid. Anbaric will also build 400 MW of battery storage capacity at the site at a cost of $400 million, it said.

"The Renewable Energy Center represents Anbaric's broader vision for its Massachusetts OceanGrid project: high capacity transmission infrastructure to maximise the potential of the region's offshore wind energy resource," said Edward Krapels, CEO, Anbaric. "As Massachusetts considers harnessing more offshore wind, the right infrastructure needs to be envisioned and set in motion. An HVDC substation is an important piece not only for Brayton Point Commerce Center, but also Massachusetts' status as a leader in offshore wind."

In April, CDC imploded two massive cooling towers at Brayton Point and set the stage for a new era of renewable energy development on the South Coast. "Developing a landing point for 1200 MW of offshore wind at the site of a former coal plant physically and symbolically represents the transformation from fossil fuels to wind," Krapels continued.

"While the region has lost a coal plant, it's quickly becoming the nexus of a new clean energy economy and emerging as one of the great energy stories in the world. This agreement is a symbol of the change that's coming – and it promises to be a very powerful economic driver in the region."

CDC purchased the Brayton Point site in Somerset, Massachusetts, last year and has since been campaigning to re-purpose it as a key logistical site for offshore wind development. The 1600 MW coal fired plant closed in 2010.

Construction of the Anbaric Renewable Energy Center is expected to begin in 2021. Together with CDC's plans for port and manufacturing facilities at the 400-acre site, it will form a key part of the supply chain in the emerging US offshore wind industry.

Earlier in May, Connecticut governor Ned Lamont announced that the state would partner with Bay State Wind to redevelop State Pier into a port facility.

Bay State Wind, a joint venture between Ørsted and Eversource, and the state of Connecticut, through the Port Authority and Gateway, will invest a combined $93 million in the port to upgrade its infrastructure and heavy lift capability.

■ The USA's power generation capacity from large solar parks and wind farms grew by 2.17 GW in the first quarter of 2019 and exceeded 136 GW in total according to government data. Capacity additions in the period also included 1.48 GW of natural gas fired power.

CFE pledges growth

Mexico's national utility, CFE, will expand its generating capacity to rescue it from "decline", its management has said.

CFE General Director Manuel Bartlett, who took control of the company in December 2018, says that he wants CFE to become once again a source of "national pride" and has pledged to fight corruption, eliminate inefficiencies and reverse financial difficulties.

News reports last month indicated that CFE would announce new tenders in 2019 for the construction of five new combined cycle gas turbine (CCGT) power plants. The move would mark a shift away from policies promoting private sector participation in the power sector, and help to restore CFE's share of the power generation mix.

In April, CFE's board approved plans for a combined cycle project in Salamanca. The 750 MW plant was launched during the previous administration but was shelved in November 2017.

Another four CCGT projects would follow later this year, according to Bartlett, who is known for his opposition to Mexico's recent energy reforms allowing private sector participation.

In a press conference in March, Bartlett said that he wants to see CFE generating more energy rather than buying it. He also pledged to review energy purchase contracts with private sector companies that participated in Mexico's power auctions, labelling them an "aberration".

■ Enel Green Power Mexico has inaugurated the 103 MW Salitrillos wind farm in Reynosa, Tamaulipas state. The $150 million, 30-turbine project was awarded to the Enel Group in the second long-term auction held in Mexico in September 2016.

St Vincent banks on geothermal

Exploration of geothermal energy resources in St Vincent and the Grenadines will help the country to boost energy independence.

The country's utility, St. Vincent and the Grenadines Electricity Company (VINLEC), has launched a national geothermal project to explore and identify geothermal resources. It says that the project will help to reduce dependence on imports of diesel fuel and in the long term, could also reduce electricity prices.

"The existence of a geothermal plant generating electricity means that VINLEC will use significantly less diesel for the generation of electricity and we will, therefore, not be as exposed to the ups and downs of fuel prices and the international market," said Thornley Myers, VINLEC CEO.

Exploratory drilling of geothermal resources is being undertaken by Reykjavik Geothermal, an Icelandic firm. VINLEC estimates that geothermal energy could provide up to 50 per cent of its electricity needs.

With approximately 16 per cent of VINLEC's electricity coming from hydro generation and the company's efforts at expanding solar, the island could be generating up to 75 per cent of its electricity needs from indigenous resources within four years, Myers said.

Increasing the use of renewable energy is a key policy in St Vincent and the Grenadines, which considers itself to be on the front line of the impact of climate change.

Brazil set for clean energy growth

Brazil is continuing to push for growth in its renewable energy sector with the creation of a new legislative group set up to attract clean energy investment.

Siân Crampsie

Brazil has created a new legislative group aimed at helping the country harness investments in clean energy.

The country's House of Representatives recently launched the Mixed Parliamentary Front for Clean and Sustainable Energy to work on legislation governing the renewable energy sector.

According to the front's coordinator, Deputy Lafayette de Andrada, having the right legislation in place will attract investment in generation, production and distribution of the country's top energy sources, in addition to reducing uncertainty for investors.

Large-scale auctions in Brazil have underpinned strong growth in the renewables sector, with wind energy now accounting for eight per cent of generation, up from zero in 2009, according to EY. Some 15 GW of wind energy is in operation in Brazil, with an additional 4 GW contracted and due to start generating by 2024.

In March, Brazil's Ministry of Mines and Energy announced six 'new energy' auctions, typically open to renewables projects, to be held over 2019-21, with the amount of power required yet to be announced.

These auctions, coupled with other proposed regulatory changes, will help to underpin continued investment in Brazil's renewables sector, according to EY.

Solar companies are eyeing growth in Brazil, which now has 2471 operating solar power plants totalling 2 GW of capacity, according to Aneel.

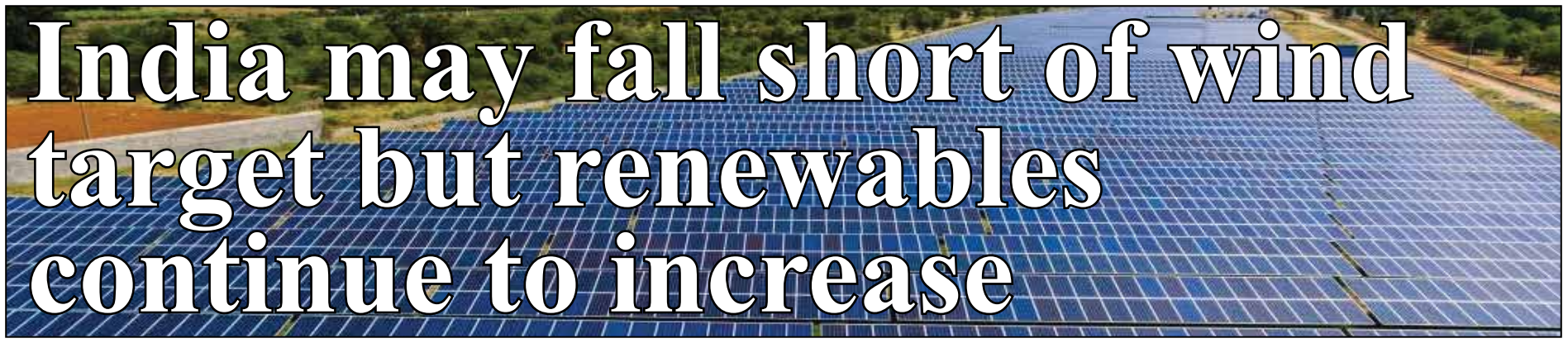
UK investment firm Faro Energy is expecting to invest over $100 million in Brazil's solar sector in the next 18 months. Faro has already built three solar farms in Brazil totalling 42 MW, and is planning to build another 22 plants.

Meanwhile a consortium led by Korean firm Enspire KSB Energy plans to invest $1.5 billion in a photovoltaic (PV) plant in Mato Grosso do Sul state.

The project will be the first investment in Brazil by Enspire KSB Energy, according to the state government.

Portugal's EDPR announced in May that it would build 20 new wind farms in Brazil's Rio Grande do Norte state over the next five years.

EDPR is expecting to invest more than BRL3 billion ($761.5 million) in the projects, which form part of four wind power complexes secured by the company in Brazil's earlier renewable energy tenders.



India may fall short of wind target but renewables continue to increase

Although solar installations continue apace, plans for new wind capacity may fall short of the 2022 government target,writes **Syed Ali.**

India is likely to install 54.7 GW of wind capacity by 2022 against the 60 GW target set by the government, Fitch Solutions Macro Research has said in a report.

The country has set itelf an ambitious target of installing 175 GW of renewable energy capacity by the year 2022, which includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydropower.

However, Fitch Solutions said in its outlook for the sector that it "remains cautious" on India meeting its ambitious 2022 targets for wind power capacity growth, as land acquisition issues and grid bottlenecks will lead to delays to project implementation in the sector.

In early May, The *Economic Times* (ET) reported that developers of many of the projects contracted in two wind auctions held in 2017 have missed their commissioning deadlines, with less than 1 GW completed of a total of 2 GW. According to the report, ReNew Power and Sembcorp are the only developers to have already built the entire amount they have won.

Wind currently accounts for more than 35 GW of the total installed power capacity and nearly 10 per cent of the overall power capacity mix, as of March 2019. The installations were down in FY 2018-19, adding around 1.5 GW in new capacity, compared to 1.7 GW of added capacity in FY 2017-18. The slowdown in installation activity can be attributed to various execution challenges, removal of incentives and switching procurement method to reverse auctions from feed-in tariffs.

Solar installations in India, meanwhile, have reached 30 GW according to preliminary figures from Mercom's India Solar Project Tracker. The share of solar capacity grew from 6.6 per cent as of March 2018 to 8.4 per cent as of March 2019. Solar accounted for approximately 38 per cent of the installed capacity, up by 2 per cent compared to the previous quarter.

Renewable energy capacity additions continue to increase, accounting for approximately 22.3 per cent of India's capacity mix at the end of the financial year (FY) 2018-19.

Total installed generating capacity stood at 358 GW at the end of March 2019, with renewables accounting for 80 GW and making up 21 per cent. This was an increase of 1.1 per cent over the fiscal year 2017-18, which had cumulative renewable energy installations standing at 70 GW.

The share of nuclear power in the total installed capacity remained the same at the end of March 2019, with no new installations recorded during the FY 2018-19.

■ Last month French state-owned utility EDF, which is contracted to build the nuclear reactors for the 1650 MW Jaitapur power plant, said India will have to provide a sovereign guarantee to two other state-run firms of France for providing financial assistance for the project.

Gencos may face cap on contracting capacities

Power generation companies (gencos) in the Philippines will be required to have a 70 per cent cap on their contracting capacities, likely by the third quarter of 2019, to ensure availability of reserve supply during times of need.

The contracting capacity of a power plant is the portion of its expected total electricity output that can be sold in advance. By limiting the amount of power that can be pre-sold to only 70 per cent, the DOE is assured that there will be 30 per cent electricity remaining to tap for emergencies.

The policy will cover new contracts, as well as those for renewal. Department of Energy (DOE) Undersecretary Felix William Fuentebella said they are now in talks with all stakeholders regarding the policy.

Luzon's grid is experiencing yellow and sometimes red alerts due to low power reserves. Fuentebella said the DOE is working to prevent this kind of situation in the future. "Our experiences should push us to come up with better policies and we're pushing the 70 per cent cap so that our power plants won't be strained so much and we would be able to address breakdowns."

■ Solar Philippines has started operating its 150 MW solar plant in Tarlac, believed to be the largest solar farm in the country, to help ease Luzon grid's power shortages.

Renewables plus storage gathers pace

■ Cellcube signs LoI for 50 MW of solar-plus-storage
■ 10 MWh gas thermal energy storage pilot starts up

Syed Ali

With an abundance of solar resources and a drive to improve grid infrastructure, Asia is continuing to deploy energy storage systems as it ramps up its use of renewables.

Last month renewables firm Pangea Energy and vanadium battery producer CellCube signed a letter of intent (LoI)to build a 50 MW storage system alongside a planned 50 MW solar farm in South Australia. Construction of the 50 MW/200 MWh grid-scale battery is expected to begin before the end of the year, with plans to be operational in 2020.

CellCube develops, manufactures, and markets its vanadium redox flow technology energy storage systems, which it says can maintain 99 per cent residual energy capacity after 11 000 cycles.

CellCube CEO Stefan Schauss said the battery would offer multiple grid services such as voltage compensation, reactive power and frequency regulation services and renewable baseload to the Australian market alongside the solar project.

The project is one of a growing number of renewables plus storage projects in South Australia. On May 1, energy storage company 1414 Degrees switched on its 10 MWh gas thermal energy storage system (TESS) at the Glenelg Wastewater Treatment Plant in Adelaide, its first commercial pilot site. The company says the technology is the first in the world to solve the issue of effectively storing biogas as thermal energy to produce heat and electricity on demand.

TESS technology takes gas or electricity from any source and stores it as latent heat in silicon which melts at 1414°C. The energy from the latent heat can then be reclaimed and distributed as electricity and/or heat when required.

Meanwhile, Indonesia's second largest coal producer PT Adaro Energy, through its subsidiary PT Adaro Power, has said it plans to complete its first commercial renewable energy power plant with a battery capacity of 6.5 MW to electrify two islands in Central Sulawesi, Paku and Umbele Morowali. The project is a joint venture with France's EDF Group.

Adaro Power Vice President Dharma Djojonegoro said that the joint venture with EDF Group was a hybrid off-grid project that combined biomass, solar photovoltaic (PV) and battery storage that would provide a 24-hour electricity supply.

"The project is still in the feasibility study [stage] to determine whether it is sustainable in terms of operation or not. We expect [the study] to finish in the next two to three months, and hopefully we can start installing the facility next year," he said.

Darma said once the power plant was operational, the electricity would be more affordable than the existing price of electricity supplied from a diesel generator.

Boost for Taiwan offshore wind

Taiwan's offshore wind plans appear to be back on track following a pause caused by uncertainty around changes to feed-in-tariffs and their structure.

In late April Ørsted announced that it had taken the final investment decision (FID) on the Changhua 1 and 2a offshore wind farm, after signing a power purchase agreement (PPA) with Taipower at the feed-in-tariff level announced on 30 January 2019.

"Over the last couple of months, we have been working intensively to obtain establishment permit, renegotiate contracts, get our supply chain plan approved and sign the power purchase agreement," said Martin Neubert, Ørsted's Executive Vice President and CEO of Offshore.

"Thanks to a close and strong collaboration with our supply chain partners, Taipower and decision-makers in Taiwan, we have achieved all these milestones and can now take the final investment decision on this landmark project, which will be Taiwan's largest offshore wind farm and demonstrate offshore wind's potential to decarbonise energy systems in Taiwan and the Asia-Pacific region."

Just weeks after the announcement, on 20 May 2019 Copenhagen Infrastructure Partners K/S (CIP) inked a priority contractor deal with CSBC-DEME Wind Engineering Co Ltd for it to install wind turbines, also off the coast of Changhua County.

Under the deal, CSBC-DEME would be tasked with transporting and installing 62 wind turbine generators for CIP's Chang Fang and Xidao projects, which would have a combined capacity of 600 MW.

Construction is scheduled to start in 2021 for both projects and be completed by the end of 2023, CIP said at the opening ceremony for CSBC-DEME's Taipei office. CSBC-DEME is a joint venture formed in 2017 by CSBC Corp, Taiwan, and GeoSea NV, a Belgian offshore solutions company.

International developers, engineers and banks have flocked to Taiwan over the past two years to take part in what promised to be one of the world's fastest growing offshore wind markets, projected to bring in $30 billion of investment to the country by 2025.

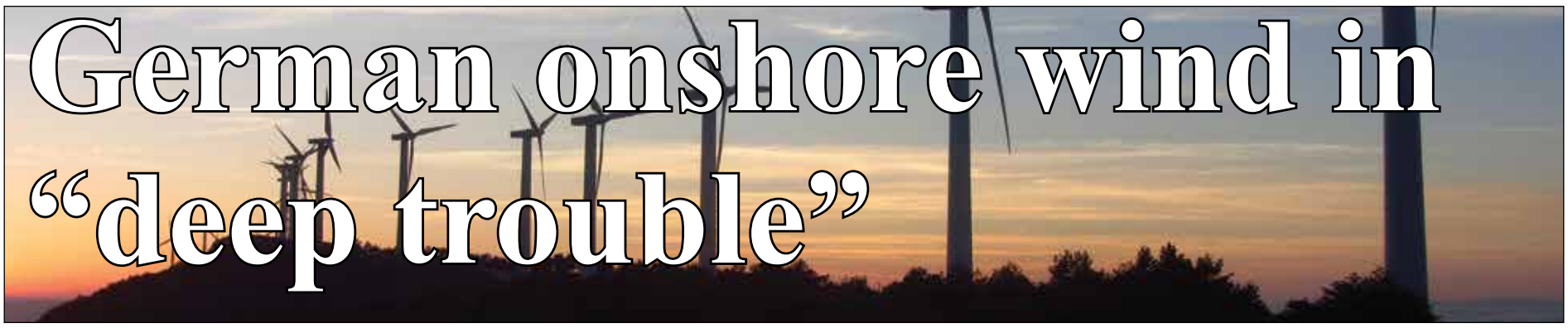
However, the country's fledgling offshore wind market was thrust into a state of flux after the government cut by nearly 6 per cent the price it would pay for power from offshore wind farms.

With confidence returning, in April the Ministry of Economic Affairs said it is aiming to increase its offshore wind energy generation capacity by 5 GW over the five years from 2026 to 2030.

Plans for the third phase of the government's offshore wind energy development project would be released later this year, Bureau of Energy Deputy Director-General Lee Chun-li told the Global Offshore Wind Summit in Taiwan.

In the first phase, a demonstration offshore wind farm with a generation capacity of 8 MW was set up off Miaoli County in 2016 and became fully operational the following year. Bidding for the second phase was completed last year, with the goal of achieving 5.5 GW of installed capacity by 2025.

German onshore wind in "deep trouble"



■ Permit bottleneck holds up 10 GW ■ German wind energy industrial base under threat

Siân Crampsie

The collapse in growth in Germany's onshore wind sector will have serious implications for German and EU clean energy targets, WindEurope says.

Germany installed just 134 MW of onshore wind capacity in the first quarter of 2019, the lowest level for that period since 2000, and it is on track to install less than 2 GW in 2019 as a whole compared with average annual installations of over 4 GW over the last five years.

Industry group WindEurope says that the drop off in installations in Germany is the result of problems in the country's permitting procedures and will jeopardise the country's 65 per cent renewable electricity target for 2030.

The gap left by onshore wind will not be filled by offshore wind, WindEurope says. WindEurope CEO Giles Dickson said: "Onshore wind energy in Germany is in deep trouble. The development of new wind farms has almost ground to a halt. The main problem is permitting – it's got much slower, more complex and there aren't enough civil servants to process the applications.

"It seriously undermines Germany's ability to meet its 2030 renewables target and contribute to the EU target."

The data from Germany is in contrast to other areas of Europe, WindEurope said in a report in April.

The organisation's latest Financing and Investment Trends report shows that €27 billion was invested in new onshore and offshore wind farms across Europe in 2018.

Although the annual figure is similar to investment levels in previous years, cost reductions achieved in the industry mean that a record 16.7 GW of wind capacity was financed in 2018.

Today, 1 MW of new onshore wind capacity now requires only €1.4 million of capital expenditure, down from €2 million in 2015.

In total 190 wind farms across 22 different countries in Europe reached Final Investment Decision (FID) last year. Northern and Western Europe still account for most new investments. The UK was the biggest investor, mostly in offshore wind. Sweden was second. Investments in Southern and Central and Eastern Europe were only 4 per cent of the total, though Spain and Poland will pick up this year.

In Germany, low installation levels are also threatening the country's wind turbine industrial base, WindEurope believes. "Half of Europe's 300 000 wind energy jobs are in Germany," said Dickson. "But 10 000 have gone in Germany in the last five years. And this could get worse: there hasn't been a single turbine order recorded in Germany in Q1 this year."

German wind power industry lobby group BWE said in April that the drop in wind turbine installations is a consequence of political mistakes that need to be corrected to ensure that renewable energy targets are met. It argues that about 10 000 MW of wind power capacity could be unlocked quickly if licensing requirements are relaxed.

Germany has set up a parliamentary working group to find ways to increase wind power acceptance but it recently got stuck over the question of whether minimum distances for new turbines from residential areas across are appropriate.

Denmark considers future wind farms

Denmark is set for large-scale offshore wind expansion after a survey identified locations for future projects totalling over 12 GW of capacity.

Denmark's Energy, Utilities and Climate Minister Lars Christian Lilleholt said recently that the survey had identified a suitable offshore wind area which could potentially accommodate a minimum of 40 GW of offshore wind capacity. From this, 12.4 GW have been designated to be developed, corresponding to 12-15 wind farms.

"Denmark is already great at offshore wind, and the survey shows that we have the potential for much more. We have such good conditions for offshore wind that we can contribute significantly to cover the need for green electricity – not just in Denmark, but also in many other countries," Lilleholt said.

Denmark outlined plans to assess its North Sea waters for further offshore wind farm development in the Energy Agreement published in 2018. Further wind farm development would take place when offshore wind no longer needed state support, Lilleholt said.

The Danish energy agreement outlined plans for a 50 per cent renewable energy target by 2030, and to make the country fossil fuel-free by 2050. It included plans to tender three new offshore wind farms with a total capacity of at least 2.4 GW by 2030. The first of these – an 800 MW project known as Thor – will be put to tender in 2019.

Denmark has several offshore wind farms in operation, approved, or under construction, including the 406.7 MW Horns Rev 3, the 605 MW Kriegers Flak, and the Vesterhav Syd and Vesterhav Nord nearshore wind farms.

Power Networks puts flexibility first

UK Power Networks (UKPN) says it is pioneering the development of flexible energy services in the grid with its latest competitive tender.

The network operator has concluded its second flexibility tender and offered contracts for a total of 18.2 MW of power from six companies across eight different locations to install or recruit new flexible capacity with a total value of more than £450 000.

The technologies involved include energy storage, demand side response, renewable energy and other generators, UKPN said.

Barry Hatton, Director of asset management at UKPN, said: "Flexibility offers a wealth of opportunities for the energy resources connected to our network like wind and solar plants, but also demand side response to help us create an open, transparent and accountable new market for their services."

The services contracted under the tender are designed to benefit UKPN's operations by reducing the need for building new assets. It used an online platform known as Piclo to host and manage the bidding process, enabling flexible energy resources to explore an interactive map that matches providers with pinch-points on the network.

"The UK is a world leader in smart grid technology and flexibility has a key role to play as we move towards a decarbonised, decentralised and digitised network that will offer significant benefits to our customers," Hatton added.

France delays nuclear shutdown

France could push back the planned shutdown of its nuclear power plants by ten years in order to help meet new climate goals.

The government has put forward new legislation designed to meet President Emmanuel Macron's aim of making the country carbon-neutral by 2050, but says that nuclear energy will be required for the new target to be met.

The new climate targets require greenhouse gas emission to fall to less than one-sixth of their 1990 levels by 2050. This compares to a target of one-quarter under current legislation.

"The current law foresees cutting the share of nuclear power [in electricity generation] to 50 per cent by 2025, but this target would have required the building of new thermal power stations, which is in contradiction to our climate aims," the government said in a statement.

"So we now propose to move the date back to 2035, which means closing 14 reactors, of which between two and four will close by 2028."

The new law will also transfer the European Union's 2018 "Winter Package" energy targets into French law and will also form the framework for a detailed "PPE" 2019-2028 energy strategy.

The draft law is due to be submitted to parliament in late June and then head to the senate for final approval later in the summer.

EnFAIT cuts tidal costs

An industry-academic collaboration has made large strides in the commercialisation and development of tidal energy.

The flagship project, known as Enabling Future Arrays in Tidal (EnFAIT), says that it has reduced the cost of tidal energy by 15 per cent and grown its supply chain from four to 14 EU countries.

EnFAIT was created just 18 months ago and is an academic-industry collaboration between nine European partners focused on demonstrating the economic viability of tidal power. The project is also paving the way for a new industrial marine manufacturing sector with a supply chain based across Europe.

Consortium leader, Edinburgh-based Nova Innovation Ltd, has reported that its Shetland tidal array – the world's first offshore tidal array – has reduced operational costs by 15 per cent since the start of the project. By 2022, when the project closes, it forecasts a cost reduction exceeding 40 per cent, which could "spark an explosion of interest" in tidal power from global investors, Nova said.

Simon Forrest, Chief Executive Officer at Nova Innovation, commented: "Even at this early stage of the project, we have achieved significant cost reduction successes, and EnFAIT is already helping to map out the world's most extensive tidal power supply chain across Europe."

Further cost reductions at the Nova installation will be driven by improvements in the design of the underwater turbines, learnings from the optimal arrangement of the turbines, and improved measurement and forecasting of tidal flows at prospective sites. Advances in forecasting, led by engineers from the Offshore Renewable Energy (ORE) Catapult, have contributed to the faster than expected cost reductions so far.

The array itself is now supplied with 100 per cent EU-manufactured content, bringing the number of EU supplier countries up from four to 14, Nova added.

"The cost reduction pathway is becoming increasingly clear," said Forrest. "As the project progresses, we are discovering new insights into the way tidal turbines interact with each other, and we are also gaining knowledge of the elegant interplay between the turbines and the tidal flows around them. This new knowledge is allowing us to maximise yield and creates the foundation for 'eureka' design moments that will facilitate further falling costs."

Unexpected Kusile bill adds to Eskom debt

- R36 billion bill for unforeseen costs at Kusile
- Eskom lays out borrowing plans

Siân Crampsie

Debt levels at Eskom, South Africa's state utility, are expected to worsen due to an unexpected bill from contractors working on the Kusile power plant.

The struggling energy company has debts approaching the R500 billion ($33.65 billion) level and is reported by local media to have received a R36 billion last month from companies working on completing the Kusile project, which is five years behind schedule and over budget.

Eskom has confirmed that it has received the bill, but has not said how much it is for, according to South Africa's *City Press* newspaper.

Last month Eskom said it would have to borrow nearly R50 billion in the current financial year to stay afloat. It has already secured around half of this borrowing requirement, but may find it harder to raise the remainder on international markets.

"Eskom has been able to raise R5.2 billion through drawdowns against a portion of committed loans, of which R4 billion was received from the China Development Bank and the issuance of domestic bonds," Eskom said.

"The government also announced R17.6 billion support for Eskom in April 2019. As at April 30, 2019, Eskom's total carrying value of the unaudited debt of the company at the end of March 2019 was R440 billion, of which R273 billion nominal value is government guaranteed."

Eskom said its funding plans aimed at borrowing R46 billion during the 2019/20 financial year from "various sources".

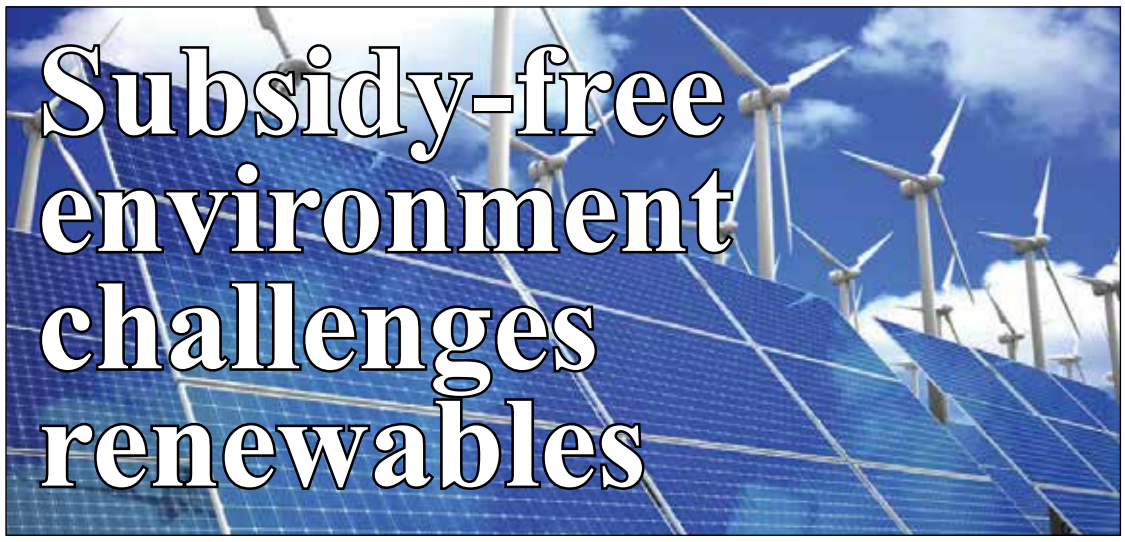
Delays in the construction of both the Medupi and Kusile coal fired power plants, coupled with technical problems at Eskom's ageing power plant portfolio, led to severe power shortages in South Africa this year.

Public Enterprises Minister Pravin Gordhan said that the delays at Medupi and Kusile were due to the power stations being badly designed and badly constructed.

According to Eskom, it will cost an additional R18 billion each to complete Medupi and Kusile, and at least another 60 to 66 months to do so. The two power plants have so far cost R290 billion to build, double their original budget. When completed, they will add 9600 MW to South Africa's grid.

Eskom's debt accounts for more than eight per cent of GDP, according to ratings agency Moody's, which has also warned that it expects the government's debt burden to rise to 65 per cent of GDP by 2023 and over 70 per cent if including guarantees to Eskom.

Subsidy-free environment challenges renewables



Renewable energy developers are facing new challenges as the industry enters a new phase of subsidy-free growth around the world, according to consultants EY.

In its latest Renewable Energy Country Attractiveness Index (RECAI) report, EY says that although falling costs are helping to drive growth in the renewables sector, projects are now having to compete in markets on their own merit without subsidies and other forms of support.

This means that projects and developers are now grappling with newfound exposure to wholesale power prices and market imbalance – known as merchant risk – and the growing role of corporate energy buyers in underwriting clean energy projects.

Ben Warren, EY Global Power & Utilities Corporate Finance Leader and RECAI Chief Editor, said: "In this more complex, subsidy-free environment, renewable developers must work harder and smarter to find the revenue certainty they need to finance or monetise their efforts. Europe has led the way with unsubsidised projects in areas with good renewable resources, and multiple projects across the Nordics, UK, and Spain are being developed which are backed by private investment and corporate PPAs to provide the required stability."

EY notes that for the renewable energy market, a future without government subsidy is one that will no longer be vulnerable to sudden shifts in policy, or to retroactive changes to promised tariffs. "Instead, it will be one where market forces impose discipline, drive efficiencies and accelerate the cost reductions that have allowed the sector to stand on its own two feet," Warren said.

Corporate purchases of clean energy rocketed last year, with a number of new companies entering the market for the first time.

According to EY's RECAI, last year PPAs supported 13.4 GW of clean energy generation, more than double the 6.1 GW of PPAs in 2017. It indicates that new companies and new countries are becoming more comfortable with a subsidy-free renewable energy environment.

For many companies, the motivation to enter into a PPA is economic – contracts that run for ten years or more, which offer a long-term hedge in the face of volatile power prices. Other companies are choosing to procure renewable energy for reputational reasons or to reduce their exposure to carbon emissions.

The Index further highlights that in a number of jurisdictions, such as Japan and Indonesia, it is difficult to enter into PPAs with developers due to regulatory barriers. However, new countries are realising that the investment into energy infrastructure need not come from taxpayers. In markets such as Taiwan, corporate PPAs are now possible, while in other markets – such as France, Spain and Australia – changing conditions are resulting in PPA volumes taking off.

EY's latest RECAI ranks China and the USA as the top two most attractive countries for renewables investment.

France moved up two positions to third from fifth in the top-40 index, led by a new focus on floating offshore wind capacity and doubling of its annual targets for onshore wind capacity additions.

Other notable gains in position have been seen in South Korea (24th position, up by seven) and Vietnam (26th position, up by 17), which made strong moves with their plans to build new renewable energy projects of 4 GW and 475 MW respectively. Norway (36th, up by nine) and Finland (39th, up by three) are bouncing back with planned new investments shored up by PPAs in a near subsidy-free environment.

Among those trending downward are Mexico (19th position, down by six) and Taiwan (33rd position, down by six), which have both suffered due to major policy uncertainty.

Siemens sets out on Iraq mission

- Siemens pips GE to the post
- Phase 1 projects outlined

Siemens plans to help Iraq rebuild its power sector have taken a major step forward with the signing of an implementation agreement last month.

The agreement cements a memorandum of understanding signed by Siemens and the Iraqi Ministry of Electricity in October 2018 and outlines the specific projects, associated budgets and timelines for the execution phase of a long term roadmap for rebuilding the country's ailing electricity sector.

The agreement is a blow for GE, which had also signed a MOU with Iraq for potential rebuilding contracts worth a reported $14 billion. The US company is still in the running to win power plant contracts in Iraq, it has told media outlets such as Bloomberg.

Siemens says that the projects in the road map include the addition of new power generation capacity, rehabilitation and upgrade of existing plants and the expansion of transmission and distribution networks. Boosting electricity is an urgent requirement for Iraq, and Siemens has also proposed a number of medium and long-term reconstruction projects and ensure the power sector is able to underpin economic growth and development.

Within the latest implementation agreement, Siemens and the Iraq government agreed on the award of contracts valued at approximately €700 million for Phase 1 of the roadmap. These include the EPC construction of a 500 MW gas fired power plant in Zubaidiya; the upgrade of 40 gas turbines with upstream cooling systems; and the installation of 13 of 132 kV substations along with 34 transformers across Iraq.

Siemens has also committed to the donation of a smart health clinic, a $60 million software grant for universities of Iraq, and the training of more than 1000 Iraqis in vocational education.

The economic viability of the plan is secured by billions of US dollars in potential fuel savings and revenue generation for the electricity sector, Siemens said.

"Our mission is to secure reliable and affordable electricity for the Iraqi people and help them rebuild their country," said Siemens CEO Joe Kaeser. "This binding agreement addresses the various aspects of the roadmap. We are also committed to supporting Iraq in arranging financing for the projects, creating attractive jobs and opportunities for small and medium enterprises.

"Investing in the country's future workforce through education and training is close to our heart. Contributing to social and economic development is at the core of what we do and forms a significant part of this agreement," he added.

Engie and EDPR team up for show of force in offshore wind

Engie and EDPR hope to challenge offshore giants such as Ørsted with a new joint venture.

Siân Crampsie

Competition in the global offshore wind energy sector is set to rise following plans by Engie and EDP Renewables (EDPR) to create a new joint venture.

The two companies have signed an agreement to create a 50-50 partnership targeting the fixed and floating foundation offshore wind markets globally.

The new entity will be the exclusive investment vehicle for both Engie and EDPR in the offshore wind sector and will bring together the two companies' expertise in project development, they said in a statement.

The move is a sign of the need for large renewable energy developers to join forces in order to compete with existing large players such as Orsted and ensure they have the financial might and technical expertise to tackle large and complex projects in emerging markets in the USA and Asia.

"The offshore wind sector is set to grow very significantly by 2030," said Isabelle Kocher, Engie CEO. "The creation of this JV will enable us to seize market opportunities while increasing our competitiveness on one of our key growth drivers, renewables. This agreement is also fully aligned with Engie's zero-carbon transition strategy."

Under the terms of the agreement, EDP and Engie will combine their offshore wind assets and project pipeline in the newly-created venture, starting with a total of 1.5 GW under construction and 4.0 GW under development, with the target of reaching 5 to 7 GW of projects in operation or construction and 5 to 10 GW under advanced development by 2025.

The company will become a global top-5 player in the field, and will be up and running by the end of 2019, Engie and EDPR said.

In a statement, the two companies said that the joint venture will primarily target markets in Europe, the United States and selected geographies in Asia. Projects will be self-financed, they added.

EDPR and Engie said that a joint venture would allow them to create "an entity with greater scale and a fully dedicated team, with global business development reach and strong power purchase agreement… capabilities". The venture will also enable them to grow their asset base rapidly and to operate "more efficiently" as a stable partnership.

The alliance follows the two firms' cooperation as consortium partners in the Dieppe Le Treport and Yeu Noirmoutier fixed offshore wind projects in France and Moray East and Moray West in the UK. EDPR and Engie are also partners in two floating offshore wind projects in France and Portugal, as well as in the Dunkerque offshore wind tender currently ongoing in France.

Antonio Mexia, EDP CEO said: "This agreement for wind offshore represents an important step in EDP's renewables strategy. We are confident that this partnership will reinforce our distinctive position in renewables allowing us to accelerate our path in offshore wind, one of the key growth markets in the next decade."

■ Vattenfall and GE have created an alliance to develop GE's new 12 MW Haliade-X offshore wind turbine. Development and production of the new turbine will take place largely in France. Vattenfall says it has already conducted an in-depth technical due diligence of the platform, which will feature a 220 m rotor and a 107 m blade.

RWE prepares for E.On integration

RWE is preparing for its integration with the renewable energy arm of E.On later this year.

The German energy giant has secured a €5 billion credit agreement with a group of international banks and says that the plan to merge with E.On's renewable energy activities is on track.

The company earlier announced that it had abandoned plans to build a new lignite power station at its existing Niederaussem site in North-Rhine Westphalia, Germany. "New coal-fired power stations no longer have a place in our future-oriented strategy," said Rolf Martin Schmitz, CEO of RWE.

Under the agreement reached in March 2018, E.On is to take over RWE's 76.79 per cent stake in innogy, while RWE is to obtain all of E.On's major renewable energy activities and innogy's renewable energy business, as well as a 16.67 per cent minority stake in E.On.

Following the completion of the transaction, which is expected in the second half of 2019, RWE will operate approximately 8 GW of renewable energy assets, including offshore and onshore wind as well as hydro and photovoltaics.

RWE said that the new credit line would be provided by 27 international banks, and was significantly oversubscribed.

Once the merger deal closes, RWE will be the world's second-largest offshore wind operator with a top five position among all renewable energy producers.

"We're on schedule in implementing our transaction with E.On. The preparation of the integration of the renewables business is also making good progress: The 'new RWE' is in sight," Dr. Markus Krebber, CFO of RWE, said.

RWE had planned to build 1.1 GW of lignite fired capacity at Niederaussem to replace the existing coal fired units at the site, which have a combined capacity of 1.2 GW.

A German government-appointed expert panel recently agreed that coal burning should end by 2038.

Utilities invest in disruptive energy management services

Feißt: looking to demonstrate energy management services

Recent investment in GreenCom Networks further demonstrates that energy companies are recognising the value of bringing disruptive technology and new services to their businesses. **Junior Isles**

Energy companies continued to demonstrate their desire to work with disruptive start-up companies last month with the announcement that innogy Innovation Hub has become an investor in Munich-based energy IoT company GreenCom Networks AG.

The investment follows a successful capitalisation round at the end of last year, when GreenCom attracted funding from UK utility Centrica. The investment from innogy Innovation Hub is for an undisclosed amount. innogy SE is a German energy company that supplies energy to around 22 million customers across Europe.

The two companies first connected through the Free Electrons energy accelerator programme, founded in 2017, which provides opportunities for later stage energy start-ups to gain access to utility customers.

Using its Energy Information Brokerage Platform (EIBP), GreenCom integrates distributed assets like solar PV, battery storage, electric vehicles and heat pumps from various manufacturers. Based on EIBP, GreenCom enables white-label end customers services like energy communities and energy flat rates.

EIBP also offers optimisation and visualisation of energy flows in homes to utilities and manufacturers of energy-relevant devices.

The investment follows a deal between the two companies in April that saw GreenCom acquire shine, an energy management services start-up founded by the innogy Innovation Hub. GreenCom will integrate shine's end-customer base and services into its energy IoT platform.

Jan Roschek, SVP Business Development & Strategic Partners at GreenCom, said: "In terms of their customer engagement models and sales and marketing initiatives, utilities don't have the well established processes to scale up technology solutions projects and get them to market. shine has established these processes. This will help the utilities we are working with to get these [solutions] to market."

shine already utilises GreenCom's EIBP and the deal will allow GreenCom to expand the services it offers on top of its EIBP platform. GreenCom says it plans to demonstrate disruptive services for residential customers that go beyond today's flat-rate or energy community offerings in the market.

Christian Feißt, CEO of GreenCom Networks, said: "The acquisition of shine is perfect for us to demonstrate how disruptive energy management services will be offered to retail customers through digital technology… the deal with shine allows us to truly demonstrate what the retail energy business will look like."

SSE continues spin-off plans despite Npower setback

UK utility SSE is continuing with plans to offload its retail arm after a deal to merge it with Npower's retail arm failed in 2018.

The company has announced plans to spin-off the business unit by mid-2020, either by listing it as a standalone company, or through "alternative ownership".

Last year SSE announced plans to merge its retail business with that of Npower, another of the UK's 'Big Six' energy retailers, but the deal fell apart when the companies failed to reach a deal to provide financial support to the new company.

SSE has now created a separate board for the retail unit, which lost 550 000 customers in the year to March 31 and which, like other retailers in the UK, is facing the competitive pressures of a crowded market.

It has also announced a round of job cuts to help it meet efficiency targets. "Like a number of suppliers, we are facing challenges due to competition increasing, the introduction of the energy price cap and higher operating costs," said Tony Keeling, SSE Chief Operating Officer and co-head of retail.

"To run a sustainable business, we need to become more efficient and ensure we have the right number of employees in the right locations to best serve our customers."

Last month SSE booked a large fall in annual adjusted profit after earnings fell at both its retail and wholesale operations. Pre-tax profit for the year through March rose to £1.37 billion, up from £864.4 million on-year, as the company benefited from the proceeds of asset sales.

Adjusted pre-tax profit, however, fell 38 per cent to £725.7 million.

Americas

Milligan order marks milestone for SGRE

An order for 66 turbines in the USA from EDF Renewables for Siemens Gamesa Renewable Energy (SGRE) has set a new record for the turbine company.

It has signed a contract to supply 30 SG 4.5-145 turbines and 36 SG 2.7-129 turbines for the 232 MW Milligan wind farm in Nebraska, bringing to 1 GW the total orders received worldwide for the SG 4.5-145 wind turbine.

The Milligan project marks the third order received by SGRE from EDF Renewables in North America in the past few months. The contract includes a service and maintenance agreement, Siemens said.

The SG 4.5-145 offers a flexible power rating from 4.2 MW to 4.8 MW depending on site conditions and has a rotor diameter of 145 m. It is optimised for medium wind onshore locations.

The Milligan wind farm is due to start operating in 2020.

Delta4000 set for US soil

Nordex has received its first order for its Delta4000 wind turbine from the USA.

The company is to supply 74 of its N149/4.0-4.5 turbines for a 350 MW wind farm in Oklahoma.

Installation is due to take place in early 2020. The order includes a Premium Service Agreement with a term of five years.

Pattern recruits SGRE

Pattern Energy Group has signed a service contract with Siemens Gamesa Renewable Energy (SGRE) covering the 218 MW Panhandle Wind I wind farm in Carson county, Texas.

SGRE's contract will span a four-year period and include operation and maintenance (O&M) of the entire fleet as well as SCADA diagnostic analysis. The contract will start this year.

The Panhandle Wind I wind farm is equipped with 118 GE 1.85-87 turbines.

Vineyard places Prysmian order

Vineyard Wind has placed an order with Prysmian Group worth €200 million to provide a submarine power cable system for the planned 800 MW Vineyard offshore wind farm off the coast of Massachusetts, USA.

With the Notice-to-Proceed expected at the end of 2019, Prysmian Group will be responsible for the design, manufacture, installation and commissioning of an HVAC (High Voltage Alternating Current) cable system composed of two 220 kV three-core cables utilising extruded XLPE insulation. The project requires a total of 134 km of power cables.

Installation operations will be performed by Prysmian Group's state-of-the-art cable laying vessels Cable Enterprise and Ulisse. Delivery and commissioning of the project are scheduled for 2021.

Ekola Flats set for Vestas hardware

Vestas has received an order for 228 MW of V136-4.2 MW turbines, operating in 4.3 MW power optimised mode, from PacifiCorp for the 250 MW Ekola Flats wind project in Wyoming, USA.

Ekola Flats is part of PacifiCorp's Energy Vision 2020 initiative, a $3.1 billion investment to expand wind power via repowering existing projects, adding 1150 MW of new wind resources by the end of 2020, and building a 140-mile transmission line segment in Wyoming.

The order includes supply and commissioning of the turbines as well as a 12-year Active Output Management 4000 (AOM 4000) service agreement. Turbine delivery is expected to begin in the second quarter of 2020, with commissioning scheduled for the third quarter of 2020.

Asia-Pacific

GS repeats Valmet order

Valmet has received a repeat automation technology order from Asia's largest capacity biomass power plant.

The company is to supply a Valmet DNA automation system and other control equipment for phase 2 of the woodchip-fired Dangjin 4 biomass power plant, which is currently under construction in the city of Dangjin, close to Seoul in South Korea.

Valmet delivered automation for phase 1 of Dangjin 4, owned by GS EPS Co., Ltd., in 2014-15. The delivery for phase 2 will take place at the end of 2019. Installation and commissioning will start in February 2020.

Completion of the 105 MW phase 2 of the project will make Dangjin the largest biomass plant in Asia. In addition to a Valmet DNA automation system, Valmet's delivery will include a vibration monitoring system, a plant performance system, an information management system, a fuel management system, a boiler protection system and a boiler environmental package system.

Decmil wins turnkey build at Yandin

Renewables infrastructure contractor Decmil has won a A$79 million ($54.7 million) contract for balance of plant (BoP) works at the 214 MW Yandin wind farm in Western Australia.

Vestas awarded the contract for the works, which will start in mid-2019.

Decmil's scope of works includes the design and construction of the civil and electrical infrastructure for the wind farm, including turbine bases, access tracks, site cabling, switch room and substation.

Earlier this year Vestas won a contract from developer Alinta Energy to supply turbines and engineering, procurement and construction services to Yandin.

The A$400 million project is due online by mid-2020.

Europe

Vestas equips Kalax

Finnish state-owned energy company Fortum Oyj has placed a turbine order with Vestas Wind Systems for the 90 MW Kalax wind project in Western Finland's province of Narpio.

Vestas will supply, install and commission 21 V150-4.2 MW machines in 4.3 MW power-optimised mode. The solution features a hub height of 155 m customised to meet the site's specific needs. The contract also includes a long-term Active Output Management 5000 (AOM5000) service agreement.

Vestas expects to begin deliveries in the second quarter of 2020. Commissioning is planned for the first quarter of 2021 at the latest.

The Kalax project was one of seven winning schemes that secured premium tariffs in Finland's technology-neutral renewable energy tender in March. It is Fortum's first large-scale wind farm in Finland.

RES bags UK O&M contracts

UK project developer Renewable Energy Systems (RES) has acquired operation and maintenance contracts (O&M) for six wind farms in England, Wales and Northern Ireland.

The contracts were previously in the hands of Ainscough Wind Energy Services (AWES), the wind energy division of the Ainscough Group, RES said. It has not provided details of the wind farms.

The acquisition is in line with RES' strategy to grow its O&M business.

DEME wins at Hornsea Two

A €200 million contract for the installation of turbines and foundations at the 1.4 GW Hornsea Two offshore wind farm has been awarded to DEME Offshore.

The Marine engineering firm will transport and install 165 monopile foundations and carry out scour protection, as well as transport and install the 165 Siemens Gamesa 8.4 MW turbines for developer Ørsted.

The monopoles will be installed by DEME's DP3 offshore installation vessel Orion. For turbine installation, the company will use its Sea Challenger and Sea Installer vessels. Turbine installation is expected to be completed by early 2022.

Valmet delivers for Kokkola Energy

Valmet is to deliver flue gas condensing and heat recovery equipment to Kokkola Energy Oy's combined heat and power plant in Kokkola Industrial Park in Finland.

The order is part of an emission reduction programme implemented by Kokkola Energy. The flue gas condensation system will improve the energy efficiency of the power plant, extend equipment lifetime and increase the district heat production capacity without CO_2 emissions.

The flue gas condensing and heat recovery equipment will be installed to the existing CFB boiler with a fuel capacity of 109 MW. The flue gas condensation and heat recovery system will produce district heat to the district heat network with a 15 MW effect. The heat produced with this system decreases Kokkola Energy's annual fuel need by an amount that equals approximately 400 truckloads.

The project is expected to be online by the end of 2020.

ABB gets in on DolWin5 act

ABB is to be the HVDC technology provider for the DolWin5 offshore wind connection project in the North Sea, it has announced.

ABB Power Grids has been awarded a triple digit million-euro order from the Aibel/Keppel FELS consortium, which will design, construct, and build the High Voltage Direct Current (HVDC) transmission system for DolWin5.

DolWin5 will deliver 900 MW of energy from three offshore wind farms 100 km off the coast of Germany to the mainland. It is scheduled for completion in 2024.

ABB's order includes the converter platform in the North Sea, as well as an onshore converter station located in Emden, in the Lower Saxony region of Germany.

International

GE boosts Azito output

Azito Energy has signed a contract with GE to deploy GE's Predix Asset Performance Management (APM) software for two GT13E2 gas turbines and two generators at the Azito III power plant, Ivory Coast.

The announcement follows the successful execution of GE's MXL2 upgrade solution on one of the plant's GT13E2 gas turbines, increasing the plant's production by 15 MW. The upgrade is set to be performed on the plant's second gas turbine unit later this year.

The combination of gas turbine upgrade and digital solution is the first of its kind in sub-Saharan Africa, GE said.

"With plant output already increasing by up to 30 MW with our selection of GE's MXL2 technology, we are keen on leveraging digital technology and knowledge management to further improve on our plant overall performance," said Luc Aye, General manager, Azito Energie S.A. "Operational efficiency, reliability and availability of our assets have always been our key focus."

Dhybrid equips hybrid sites

German hybrid specialist Dhybrid has received an order from Omexom to supply seven PV-diesel hybrid systems in remote Senegalese locations with sophisticated hybrid control and energy storage systems.

The project will enable Senegal to supply power for very isolated sites and to diversify its energy mix. It is part of a €26.8 million investment, financed by the German bank KFW and Senelec, the national electricity company of Senegal, consisting of the hybrid sites and an additional 15 MW PV installation.

Dhybrid will supply its proprietary Universal Power Platform (UPP) – a modular Energy Management System (EMS) and SCADA solution that will manage, control and monitor the interaction between diesel generators, PV inverter and energy storage system to minimise the electricity costs and CO_2 emissions. In addition, the German company will supply containerised lithium-ion energy storage systems, automatic generator controllers and the main electricity distribution panels.

RR engines assist Slovakia

Rolls-Royce has signed a contract with EPC contractor TTS Martin, s.r.o. for the supply of a 28 MWe power plant for state-owned utility Martinska teplarenska, a.s. in Slovakia.

The plant will be equipped with three Rolls-Royce Bergen B35:40V20AG2 natural gas engines and four hot water boilers, replacing the utility's entire existing coal operation. As well as electricity, the engines and boilers will supply over 28 MW of heat to most of the 60 000 population of the cities of Martin and Vrutky. The new plant is planned to go into commercial operation at the beginning of 2020.

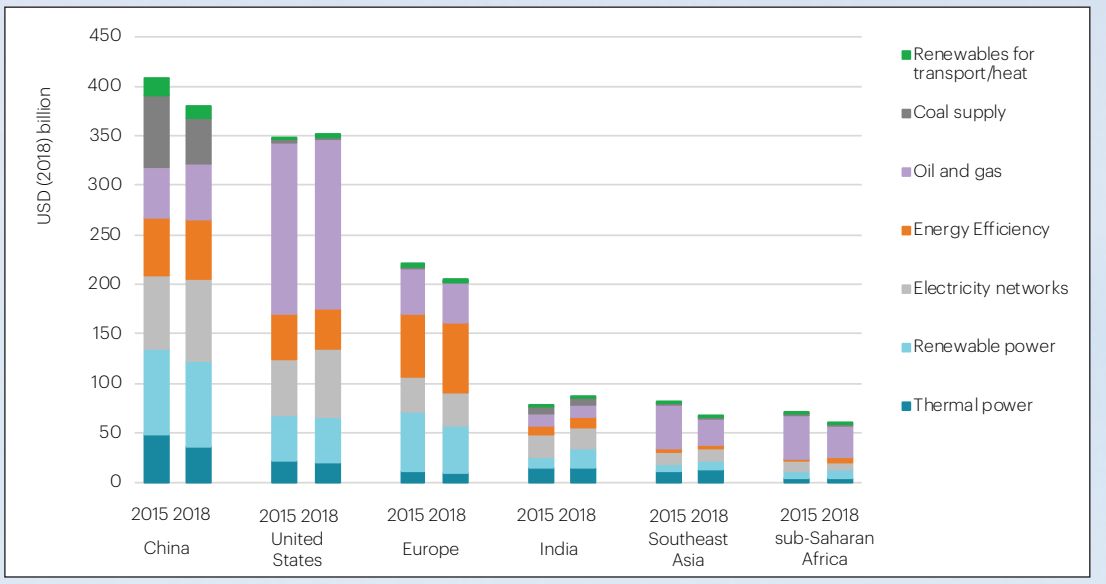
ContourGlobal chooses GE for Kosovo

Power firm ContourGlobal has named GE as its preferred bidder for a 500 MW coal fired power plant in Kosovo.

The new plant will replace the Kosovo A coal fired power plant, which, along with Kosovo B, provides 90 per cent of Kosovo's electricity. Financing for the $1.3 billion project is likely to come from a mix of the Overseas Private Investment Corporation (OPIC) and export credit agencies, according to reports.

The other bidders for the project were China Machinery Engineering Corporation (CMEC), South Korea's Hyundai and a consortium of Turkey's ENKA, Japan's Mitsubishi Hitachi Power Systems and Spain's Tecnicas Reunidas.

Energy investment by sector in selected markets, 2015 and 2018



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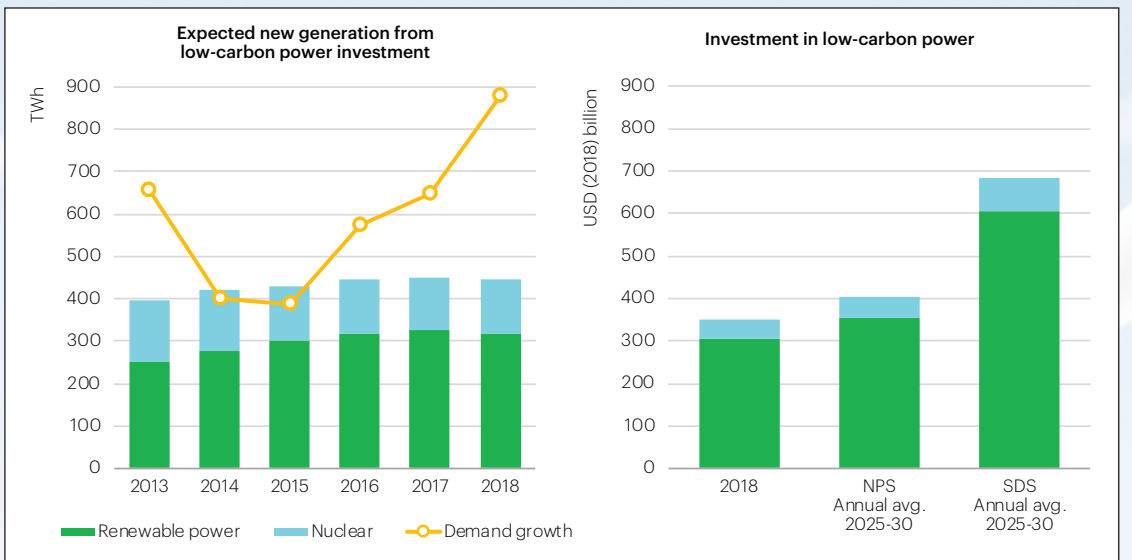
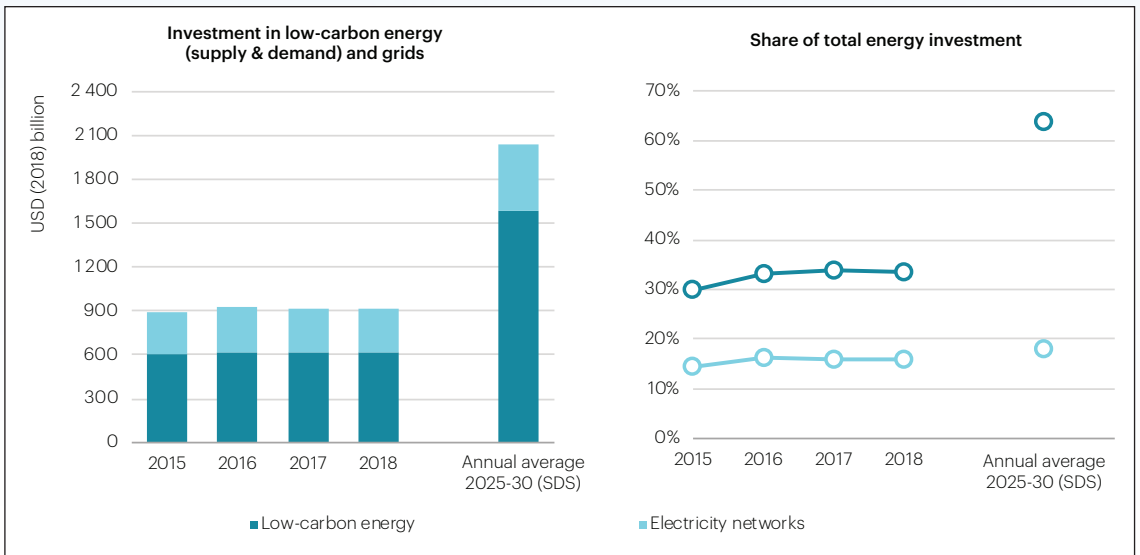
Expected generation from low-carbon power investments and annual investment needs by scenario



Note: Generation is based on the expected annualised output of the capacity associated with investment in a given year. TWh = terawatt hour. NPS = New Policies Scenario; SDS = Sustainable Development Scenario.

Global investment in low-carbon energy, including efficiency, and electricity networks compared with investment needs (SDS)



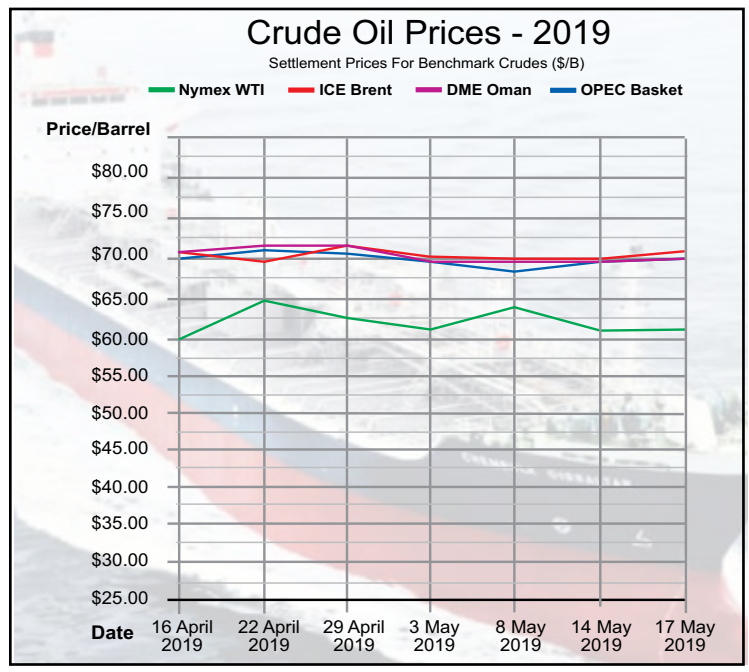
Note: Low-carbon energy investment includes energy efficiency, renewable power, renewables for transport and heat, nuclear, battery storage and carbon capture utilisation and storage. SDS = Sustainable Development Scenario.

Source: World Energy Investment 2019 © IEA

Oil

Crude market remains calm and balanced

- Saudi Arabia does not see any shortage in supply to oil market
- Current production rate expected into July



Mark Goetz

The crude oil market during the month of May has not been rocked by shortages from Iran, Libya or Venezuela, despite the outlook a month ago when there were questions about how the cancelation of US waivers for Iran crude purchases, the escalating war in Libya, and the growing social and economic uproar in Venezuela might have on oil markets.

Between the first of May and mid-month, the price of Brent crude averaged in the $70/b to under $73/b range and West Texas Intermediate (WTI) moved between $61/b and $63/b.

It has been considered that those circumstances had the potential to throw oil prices into uncertainty, but even attacks on oil tankers in the UAE port of Fujairah, near the strategic Strait of Hormuz, and drone attacks on oil installations in Saudi Arabia by Houthi rebels in Yemen, failed to make a significant impact on prices. Neither did the contamination of Russian oil moving to European markets through the Druzhba pipeline, a problem that is being cleared up.

Political tension between the US and Iran continues to be a prime concern after Washington moved a carrier group into the Persian Gulf region, and further sabotage against Gulf shipping remains a factor as the consequences of oil sanctions against Iranian crude will mount. Furthermore, the Houthis have promised to continue their attacks against Saudi oil installations following the attack on Saudi Arabia's East-West pipeline, which terminates at the Red Sea port of Yanbu.

Saudi Arabia's Petroleum Minister Khalid al-Falih, remains cool about the status of the oil market, apparently unworried by events in the region, Libya or Venezuela. Speaking in Jeddah prior to a meeting of the Opec/non-Opec monitoring committee, Falih said he could not see any shortage in supply to the oil market, noting that inventories were actually rising in some countries like the US.

"I am not sure there is a supply shortage, but we will look at the (market) analysis," he was quoted by *Reuters* as saying. "We [the monitoring committee] will definitely be responsive and the market will be supplied. But all indications are that inventories are still rising. We saw the data from the US week after week, and they are massive increases, so there is obviously supply abundance."

The Opec/non-Opec alliance will meet at the end of June to assess oil market conditions and decide whether to adjust oil production. Last year, they agreed to cut 1.2 million b/d from the market for six months beginning January 2019 in order to boost prices, or put the market "in balance" as Falih describes it.

"We will be flexible. We are going to do the right thing as we always do," he said, adding that Opec is guided by two principles: one, to keep the market in its direction towards balancing, and inventories are back to a normal level; and two, to be responsive to market needs. "We will strike the right balance I am sure," he told *Reuters*.

Opec leader Saudi Arabia will produce 9.7-9.8 million b/d during May and June, more than 500 000 b/d beneath its agreed production quota of 10.31 million b/d. Furthermore, its exports will remain at around 7 million b/d.

During the meeting in Vienna, parties to the production cut will decide whether to extend them or not. Saudi Arabia is expected to continue its current production rate into July and perhaps further even if the other oil producers decide to increase output.

At some point, however, Venezuela will snap and Libya will either find peace or give way to more violence. The chairman of Libya's National Oil Corporation (NOC), Mustafa Sanalla, warned in mid-May that continued fighting between Libya's factions is putting 95 per cent of the country's oil production under threat. Libya is back to producing more than 1 million b/d of crude, but it has experienced steep declines in the past.

For its part, Iran has made it clear that it will do whatever it takes to evade US sanctions. Iran's crude exports have declined to around 500 000 b/d in the wake of renewed US sanctions. The country was exporting more than 2 million b/d before the US pulled out of the Iranian Nuclear Accord last year. An Iranian maritime official stated that the country has adopted new tactics and new destinations.

Gas

Mozambique approves Rovuma LNG development plan

Approval of the development plan for the first phase of the Rovuma LNG project could signal the start of the transformation of the country's economy.

David Gregory

The government of Mozambique last month approved the development plan for the first phase of an LNG project that could eventually transform the Mozambican economy. The Mozambique Rovuma Venture (MRV), an ExxonMobil and Eni-led consortium, submitted the plan in July last year, detailing the offshore upstream development of Area 4, where some 85 trillion cubic feet of gas has been discovered, and the construction of two LNG trains on the Afungi Peninsula that will each produce 7.6 million tons annually of LNG for an initial total of 15.2 million t/y.

The Afungi Peninsula in Cabo Delgaro Province in northern Mozambique is remote and underdeveloped. As part of the development plan, the operators have committed to resettling the people who live there and to providing job training for hundreds of people with the intention of employing them at the site as well as making improvements for surrounding communities.

"The development plan details our commitment to train, build and employ a local workforce and make gas available in support of Mozambique's industrialisation," Eni's Chief Development, Operations and Technology Officer, Alessandro Puliti, said.

The partners in Mozambique Rovuma Venture intend to make a final investment decision (FID) before the end of this year, which targets first production at 2024. The project will ultimately draw natural gas from three offshore reservoirs in Area 4 that will be developed by Eni, which will be in charge of upstream construction and operation. ExxonMobil, which is invested in some 17 LNG trains worldwide, will construct and operate the onshore LNG facilities. Preparation of the Afungi site, which has been identified as the Mozambique LNG Park, is already under way.

The company has already reached sales and purchase agreements for the full volume of production from the two trains and has submitted those agreements to the government for approval.

The facility will also produce a significant amount of liquefied petroleum gas (LPG) from Area 4 production for the local market. Some 17 000 tons are to be produced each year, covering about 50 per cent of the current volume of imports.

MRV partners include ExxonMobil, Eni and China National Petroleum Corporation, which together hold 70 per cent of the group. Kogas, Galp Energia and Mozambique's state-owned Empresa Nacional de Hidrocarbonetos EP (ENH) each hold 10 per cent.

Meanwhile, Eni is proceeding with the Coral South project, which involves installing a floating LNG (FLNG) facility in Area 4. The vessel will draw gas from six subsea wells and sell the LNG to BP under a 20-year contract. The $7 billion project will produce 3.4 million t/y beginning in 2022.

Mozambique has another large LNG project that is also making headway in concert with the ExxonMobil-Eni plan. The Mozambique LNG project, headed by Anadarko and focused on offshore Area 1, which is adjacent to Area 4, is due to make its FID by mid-June.

"With commitment for financing in place, off-take secured, and all other issues under negotiation successfully addressed, we are excited to take the next step with the expected announcement of a [FID] for the Mozambique LNG project on June 18," Anadarko CEO Al Walker said last month after a meeting with Mozambican President Filipe Nyusi.

Mozambique LNG and MRV have agreed to work together in the creation of the new LNG processing facility on the Afungi Peninsula, but each are constructing their own LNG trains. The Anadarko-led consortium will draw natural gas from 75 tcf that has been discovered in the Golfinho/Atum field in Area 1. The field is operated by Anadarko Mozambique Area 1, a wholly-owned subsidiary of Anadarko with a 26.5 per cent working interest. Two trains will produce 12.88 million t/y of LNG.

Anadarko's partners in Mozambique LNG include Mitsui, Thailand's PTT, India's ONGC Videsh and Bharat Petroleum Resources, plus ENH.

Once the gas resources are developed and LNG comes on-stream, Mozambique will rank as one of the largest LNG producers in the world. Changes to its economy will be profound. Investment in LNG will bring tens of billions of dollars to the projects, and the construction of additional trains will see the facility produce tens of millions of tons of LNG every year. The Mozambican government will face a significant challenge with managing the revenues that LNG sales will deliver. If managed well, the gas revenues could be transformative for the economy.

Offshore wind is going global

The falling cost of energy from offshore wind farms is driving the sector's development. **Junior Isles** speaks to the Global Wind Energy Council's CEO, Ben Backwell about what's in store in the near- to mid-term.

This year's Global Wind Report, published in April by the Global Wind Energy Council (GWEC), showed that 2018 was a year of steady growth for the industry. The report, however, also revealed that last year was a pivotal year for offshore wind. Notably, China installed and connected about 1.8 GW of new offshore wind capacity – more than any other country – thereby leading the charge of Asia, which is expected to lead global growth in the coming years.

According to the report, global offshore wind capacity added in 2018 amounted to 4.5 GW – the same as in 2017. This brought total cumulative installations to 23 GW, representing four per cent of total cumulative installations. The current share of total global offshore installations represents four per cent of the total 591 GW installed. By 2025, that share is expected to exceed 10 per cent and the total installed base could reach 100 GW.

GWEC believes the offshore market will become "a truly global market" over the next five years. It expects increasing offshore installations first in Asia and then in North America, and annual offshore installations reaching 6 GW or more in the near future.

While Europe will continue to add 3-4 GW per year based on current targets and planned auctions, Asia could add between 5 to 7 GW of new installations per year if governments stay committed and investments are executed, says the GWEC report. Meanwhile, the first large scale offshore installations are expected in North America towards 2022 or 2023 and GWEC Market Intelligence expects about 1 GW towards 2023 to 2025.

"It's an exciting time for the industry," said Ben Backwell, CEO at the Global Wind Energy Council. "Asia becomes a larger market than Europe in terms of annual installations probably by 2020. There will be a big uptick in China, which awarded a number of projects as people moved to get in on the feed-in-tariffs (FITs) before it moves to a provincial auctioning system. So there is a huge pipeline of projects that have been approved in China. US and Taiwan projects are also being built-out, so we are expecting a pretty big increase over the next five years."

In addition to Taiwan and China, the report notes the key growing offshore wind markets in Asia are South Korea and Japan. In these markets, investments in projects and supply chains are progressing, and projects are maturing. India and Vietnam are in the early stages, but with an offshore wind potential of 27 GW (Vietnam) and 60 GW (India). Vietnam has already installed 99 MW of offshore capacity. The Indian government, meanwhile, has set an offshore wind target of 5 GW by 2022 and 30 GW by 2030.

Backwell commented: "Vietnam will probably come along sooner than most people think; there are some big projects that are being done right now, and India has its tender that it is holding."

A big driver for offshore wind has been the falling price of energy from projects. This is being driven by market mechanisms, namely the move from FITs to auctions, as well as by technology advances.

"The move to an auctioning system is ultimately a positive development," said Backwell. "In Europe we've seen it bring down costs to make it competitive with other power sources. It's a lot cheaper than nuclear, which is one of the alternatives often thought about in Asia, and can be competitive with new-build gas and coal. Going to an auctioning system in Europe has been absolutely key in putting offshore wind in a different place in terms of how policy makers consider it.

"At the same time, turbines keep getting bigger with sizes of 12 MW machines being announced. Digitalisation, sensors, and monitoring etc., are helping to improve performance and capacity factors and great progress is being made in floating turbines. We expect floating [turbines] to become an important part of the market over the next ten years. There are pilots already out there and we expect the technology to become industrialised pretty quickly."

Proof of how offshore wind costs have come down was demonstrated in Germany last year, where the second tender for offshore wind again included a project bidding for €0.0/MWh support (repeating the zero-priced bids of the first round in 2017 and meaning that the project will only receive the wholesale price of electricity and no further support/payment).

Backwell believes the same will eventually happen in China, where the offshore wind prices are not as competitive as they are in other countries. "They would like to get to European levels of competitiveness, so the Chinese government is having a big push on provincial auctions. They are also moving further offshore, where they can build bigger projects and increase capacity factors.

"They are also looking to get more foreign involvement in projects," he added. This is an area in which GWEC is increasingly becoming more active, as countries need to adopt best practices and bring in new skill sets.

"There are other markets we're looking at as part of the work we're doing with the World Bank," said Backwell. "There are a whole bunch of markets that are not on the radar yet. There are a lot of good resources around the world that haven't even been looked at… including east Asia, Indonesia; around the north and south of Australia; down the coast of Brazil and Argentina; a few places in the Caribbean; Central America; down the southern tip of Africa and the northwest of Africa."

Under a programme announced in March, the World Bank and sister organisation International Finance Corporation (IFC) will help emerging markets assess their offshore wind potential and provide technical assistance to develop a growing pipeline of projects that are ready for investment by renewable energy developers.

This work will be carried out in co-operation with GWEC and its recently formed Offshore Wind Task Force, which brings together leading offshore wind developers, equipment manufacturers and service providers.

Led by the World Bank's Energy Sector Management Assistance Program (ESMAP), the $5 million programme is being initiated thanks to a £20 million ($26.4 million) grant to ESMAP from the United Kingdom government to help low- and middle-income countries implement environmentally sustainable energy solutions.

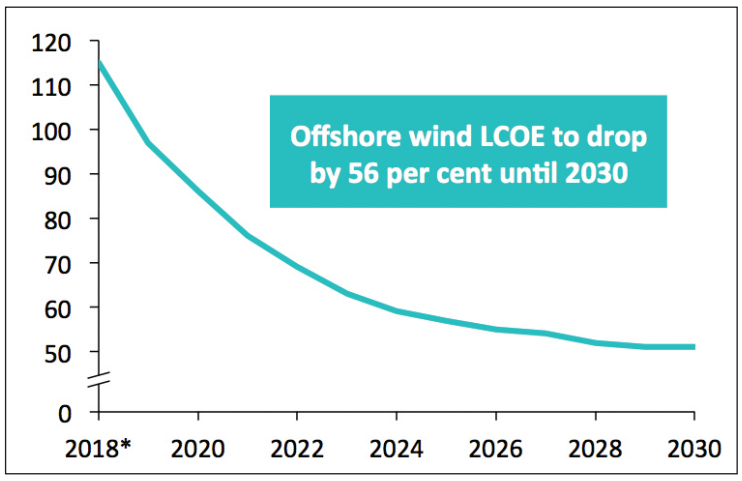
The initiative presents an important opportunity for countries with strong offshore wind resources, including Brazil, Indonesia, India, the Philippines, South Africa, Sri Lanka and Vietnam. Vietnam's technical potential for fixed and floating offshore wind is 309 GW, while South Africa and Brazil have 356 GW and 526 GW in total technical offshore wind potential, respectively.

Outlining GWEC's role in the initiative, Backwell said: "We are helping with outreach, industry liaison, organising events and policy seminars, etc. The first one will be in London, UK, at the end of June, which will involve a number of governments that will be sending delegations."

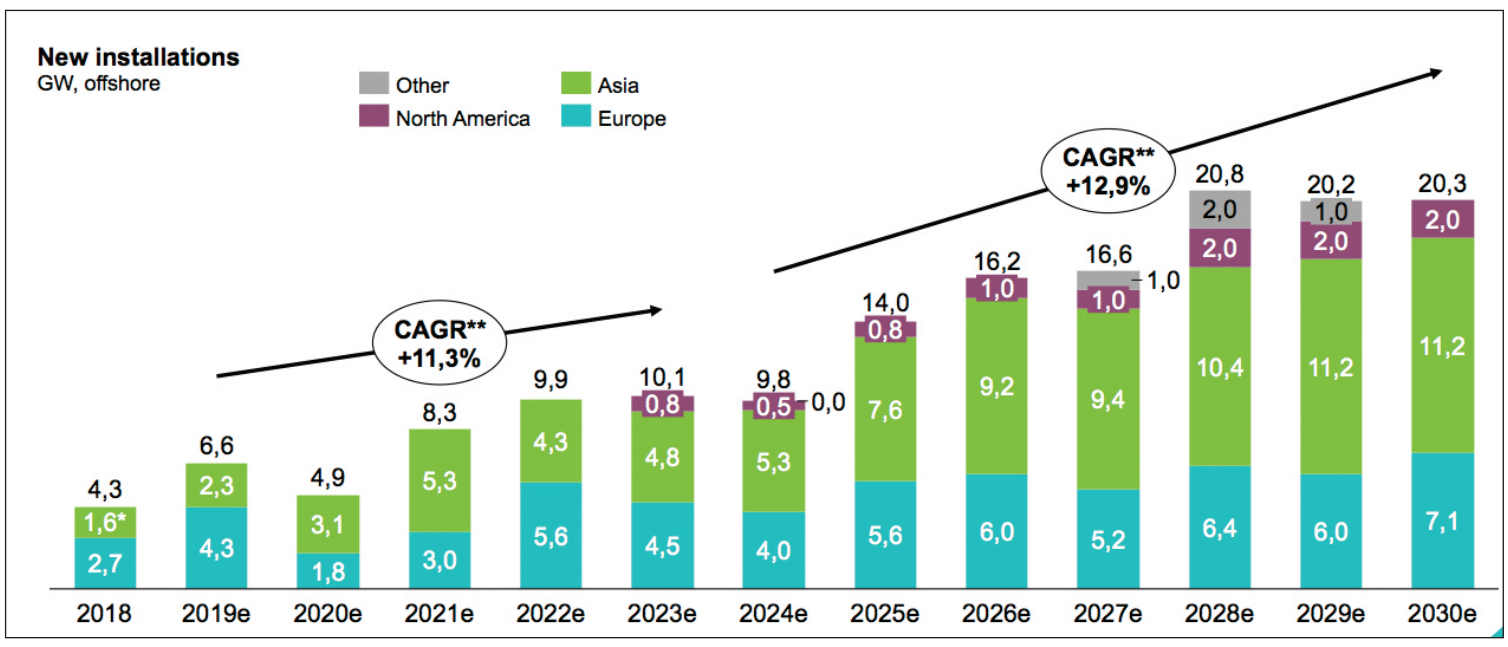
The idea, he says, is to take offshore wind beyond existing markets, particularly to non-OECD markets. "The aim is to create a programme for the countries that are interested, to help them develop their offshore wind and eventually create funding streams for them as well."

According to the World Bank, offshore wind now represents about $26 billion in annual investments or 8 per cent of new global investments in clean energy and this proportion is set to increase dramatically, with about $500 billion expected to be invested in offshore wind projects by 2030.

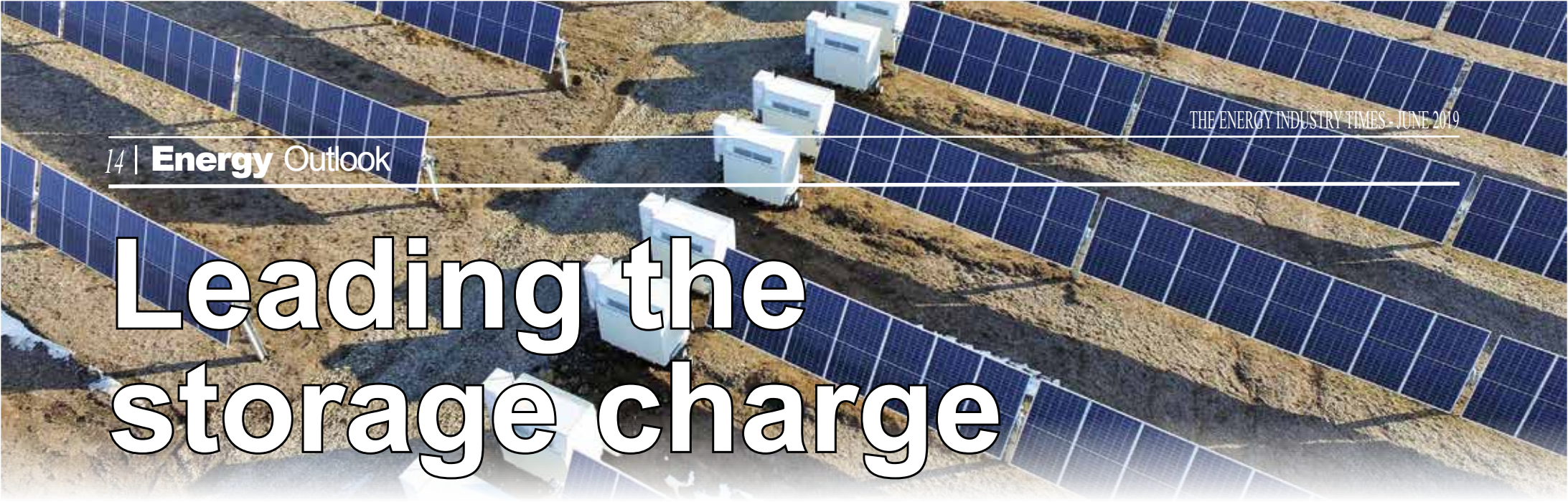
Looking forward, GWEC expects the percentage of offshore wind in the overall annual wind installations to grow fairly steadily. As Backwell summed up: "We expect to get to around the 20 per cent level pretty fast. That's a pretty impressive chunk of what's going to happen globally from now on."



Forecasted levelised cost of electricity offshore wind, USD/MWh



GWEC offshore market outlook to 2030



Leading the storage charge

A recently published report by Wood Mackenzie predicts solar-plus-storage prices for both utility-scale and distributed commercial & industrial segments will decline considerably over the next five years. ***TEI Times*** reports.

As might be expected for a part of the world that receives good levels of sunshine all year round, it is not surprising that solar photovoltaics (PV) represents one of the fastest growing renewable energy sources in the Asia-Pacific region.

According to Wood Mackenzie Power and Renewables' global solar PV market outlook update, the Asia-Pacific region is set to install 55 per cent of all the world's new solar PV in the next five years. Cumulative capacity in Asia-Pacific, including Australia, will increase by 60 per cent, from 222 GW in 2017 to 578 GW in 2023. China, India and Japan together will account for 78 per cent of this capacity increase.

Yet such rapid growth of a variable energy source sometimes results in curtailment, due to over production of electricity that cannot be fed into the grid. This has in turn led to a growing demand for battery storage. The cost of storage, however, is often cited as one of the obstacles that needs to be overcome to enable solar to really take centre stage in the future energy mix. But it is a scenario that is set to change before too long.

In May, Wood Mackenzie published a report, that projects solar-plus-storage prices, or levelised cost of electricity (LCOE), for both utility-scale and distributed commercial and industrial (C&I) segments are to decline considerably over the next five years.

The report reveals some interesting findings based on LCOE for a 4-hour lithium-ion solar-plus-storage. Research Analyst for Asia Pacific, Rishab Shrestha, commented: "If you look at the production profile of solar energy, you have a production peak at around 12 noon or 1 pm. And if the system demand typically has a morning peak and even larger evening peak demand, then four hours is usually enough to store excess solar energy. If you increase the [storage] period to more than four hours, the cost can increase quite a bit so that's why we usually see four hours or less."

The study predicts that such a utility-scale solar-plus-storage system will command a cost premium between 48 per cent and 123 per cent over solar-only LCOE in 2019. On the distributed C&I solar-plus-storage front, the storage premium over solar LCOE is between 56 per cent and 204 per cent this year.

The reason for such a wide LCOE range, says Wood Mackenzie, is because "there are some mature markets where solar cost is extremely competitive while others are not and some in-between". This is due to a mix of labour, land, environment, civil costs, weighted average cost of capital, and procurement methods, tenders vs feed-in tariffs (FIT), etc. Also, some markets have very well established supply chains with the availability of storage manufacturing.

Shrestha commented: "We covered several APAC markets that are at various stages of solar maturity. Some have storage manufacturing, while some do not. India for example, has a very competitive solar price compared to Japan, which has a very high solar price." The cost premium over solar-only in a market such as India would therefore be higher than in Japan.

LCOE depends on a range of factors such as capex, including balance-of-system cost, module cost, inverter cost, battery cost etc. In addition, there is the cost of financing, which can be impacted by the type of business model.

Whether solar-plus-storage can be competitive largely depends on several market factors. For example, it could make economic sense in replacing expensive peaking units.

Subsidy mechanisms such as green certificates and feed-in tariffs can also make the difference. Shrestha said: "If you look at India, where there might be procurement from a central government specifically for solar-storage projects, there are projects that can make economic sense."

If Wood Mackenzie's forecasts are proved correct, many more projects will become increasingly financially viable.

The report predicts that the cost premium for unsubsidised utility-scale LCOE for a 4-hour lithium-ion solar-plus-storage will reduce to between 39 per cent and 121 per cent in 2023. On the distributed C&I solar-plus-storage front, the premium over solar LCOE over solar-only will narrow to between 47 per cent and 167 per cent in 2023.

"In general, we expect the average solar-plus-storage LCOE in Asia Pacific to decrease 23 per cent from $133/MWh this year to $101/MWh in 2023," said Shrestha. "By then, solar-plus-storage costs would already be competitive against gas peakers in all the National Electricity Market (NEM) states of Australia. The country's utility-scale solar-plus-storage LCOE will hover at about 23 per cent above average wholesale electricity price."

He added: "Based on gas prices, in Victoria the LCOE [of solar-storage] is just about where the peaking plants are at the moment. By 2023, LCOE will be able to undercut all of the states."

According to Wood Mackenzie, only Thailand is expected to have a utility-scale solar-plus-storage LCOE below the average wholesale electricity price by 2023. "While the country does not have a wholesale electricity market, industrial power price taken as a proxy is higher compared to other wholesale markets and hence shows competitive solar-plus-storage economics," it stated.

Unsubsidised C&I solar-plus-storage is expected to be competitive in Australia, India and the Philippines by 2023.

"The residential market also poses a great opportunity for solar-plus-storage," said senior analyst Dr. Le Xu. "In 2018 with the help of government subsidies, Australia's New South Wales saw a 76 per cent savings on annual electric bills through solar-plus-storage installations."

Another attractive residential solar-plus-storage market is Japan. FITs for 600 MW of solar projects are poised to expire this year. As power prices are set to increase, storage retrofits provide an opportunity for home consumers to avoid high residential prices.

Indeed, Wood Mackenzie notes that in general, capex subsidies and additional remuneration through different forms of renewables certificates will be crucial for projects to go-ahead. Certainly there is evidence that financial support can stimulate markets.

"If you look at South Korea, that is a good example, where they have Renewable Energy Certificates to try to drive solar-plus-storage," said Shrestha. "With these certificates you will be compensated at five times their value during the peak hours. This is driving demand."

As installations increase, along with technology improvements, this will drive down the cost of battery storage and drive further investment.

According to BloombergNEF (BNEF), the global energy storage market will grow to a cumulative 942 GW/2857GWh by 2040, attracting $620 billion in investment over the next 22 years. Its 'Long-Term Energy Storage Outlook' published in November shows the capital cost of a utility-scale lithium-ion battery storage system sliding another 52 per cent between 2018 and 2030, on top of the steep declines seen earlier this decade.

In a more recent report, released by GlobalData at the beginning of May, the global battery energy storage market is forecast to grow by 7 per cent to reach $13.13 billion by 2023.

Its latest report: 'Battery Energy Storage Market, Update 2019 – Global Market Size, Competitive Landscape and Key Country Analysis to 2023', reveals that the fall in technology prices and increasing pace of development in the power market are the primary driving factors for the battery energy storage market.

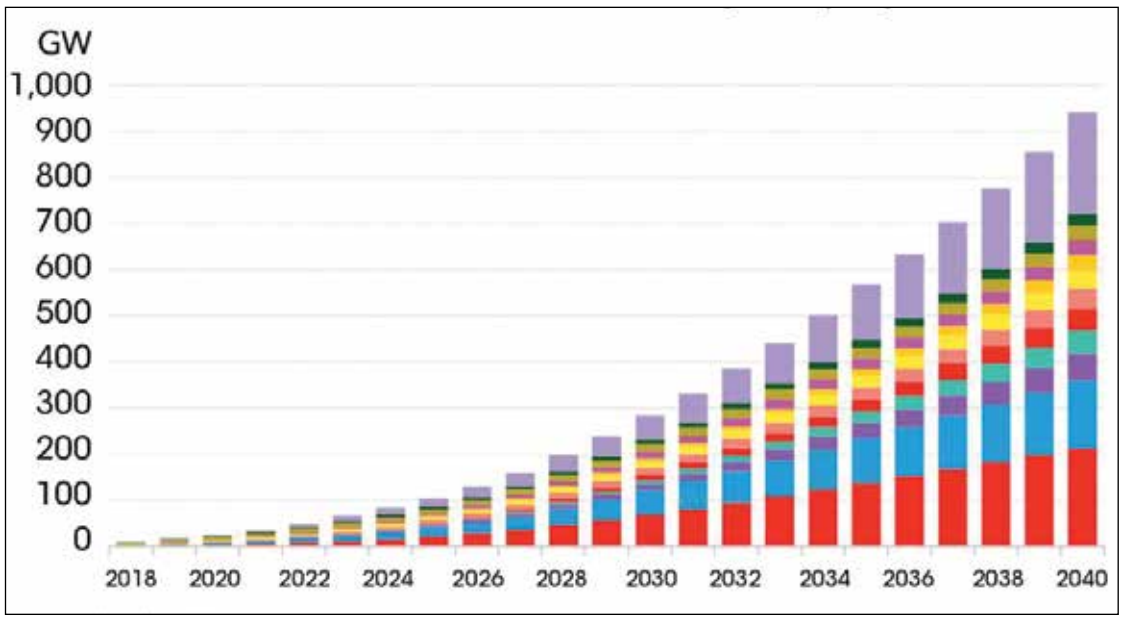
It says APAC will continue to be the largest market reaching $6.05 billion in 2023, as countries increase investments in grid infrastructure to improve the market structure and attract foreign investment. Asia-Pacific accounted for 45 per cent of the global market installed capacity in 2018 and is expected to maintain its top position in the forecast period 2019-2023.

With the number of grid-connected renewable electricity generation plants increasing rapidly, countries such as China, India, Japan, South Korea, and the Philippines will focus on frequency regulation to normalise the variation in power generation from renewables, the report said.

Bhavana Sri, a power analyst at GlobalData, said: "With countries aggressively promoting the modernisation of grids, and developing their capability to handle the demands of the present and future, batteries are being deployed to support smart grids, integrate renewables, create responsive electricity markets, provide ancillary services, and enhance both system resilience and energy self-sufficiency.

"Market conditions are improving and more companies are moving into decentralised generation, leading to an increase in the onsite deployment of renewables and batteries; as with micro or mini girds. Supportive policies and high electricity charges are also nudging the market towards renewables and/or storage plus renewables at the end-consumer level. As the power sector evolves to accommodate new technologies and adapt to varying market trends, energy storage will play a central role in the transition and transformation of the power sector."

Nevertheless, storage is still in its infancy. The market will need to fairly compensate the value storage provides in order for storage paired renewables to take-off. Business models still need to be refined according to market design and future policy options. The Wood Mackenzie report also noted that safety and fire hazards need to be looked at carefully and concludes that once these challenges are addressed, solar-plus-storage will be "a great asset" for the power grid.



Global cumulative storage deployments to 2040. *Source BNEF*

Gearing up for hydrogen

Work is under way at the Groningen power plant in the Netherlands to convert one of its units to run on 100 per cent hydrogen. **Junior Isles** speaks to Mitsubishi Hitachi Power Systems about the importance of the project and the prospect of a hydrogen economy.

Hydrogen's potential as an emission-free energy carrier is being increasingly recognised, with projects and programmes aimed at demonstrating the possibilities gaining momentum.

Much of the recent spotlight is currently being shone on its role in providing long term, seasonal energy storage for intermittent renewables. Here, electricity produced from excess wind and solar can be utilised by electrolysers to produce 'green' hydrogen. This can then be used in fuel cell electric vehicles or trains, thereby decarbonising transport. It could also potentially replace natural gas in heating systems, or even in industry.

But there is also huge potential in the power sector, where there is a growing interest in using hydrogen to replace natural gas as a fuel for gas turbines.

Professor Emmanouil Kakaras is SVP of Power and Energy Solutions Business of Mitsubishi Hitachi Power Systems (MHPS) in Europe, which is currently working to convert Vattenfall's Magnum gas fired combined cycle power plant in Groningen, the Netherlands, to run on hydrogen. He believes the possibilities for hydrogen are real.

"Hydrogen is becoming more important as an energy carrier, as there is an increasing over-supply of renewables to the grid and a growing need to store this excess electricity as another form of energy for a longer period. It's a problem we are beginning to see in some European countries and we are looking for the first applications that will not demand a massive infrastructure system for the hydrogen. That means single point of consumption is important to demonstrate the merits of energy storage with hydrogen. Just introducing hydrogen into the power cycle is not the most efficient way to do it but the question of size and infrastructure needed has to be considered."

Professor Kakaras says we will need to see carbon-free thermal projects by around 2040

The Groningen project is part of a wider drive, which in January 2019 saw Europe's gas turbine industry launch a range of commitments towards the transition of gas power generation to renewable gas, such as hydrogen, in line with the EU's 2050 goal of a climate neutral economy.

The objective is to convert one of the three 440 MW combined cycle gas turbine units to combust only hydrogen by 2025. Professor Kakaras explained the need for such projects: "You can decarbonise electricity with renewables but there will always be a part of the generation mix that has to be thermal, e.g. for stable grid frequency, supplying backup power when renewables are not available. So if you want deep decarbonisation, this 'last mile' of decarbonisation – the thermal part of it – can be done with hydrogen. It is the only available alternative."

Professor Kakaras believes the Groningen project is of paramount importance to the hydrogen economy. "If you look at the scale at which industries are utilising hydrogen, we are talking about tens of MW in the oil and gas industry, with refineries absorbing hydrogen from electrolysers in the 10 MW scale. And some projects in Germany have been announced with electrolysers in the 100 MW scale. Now we are talking about a single point of consumption that is 440 MW."

He added: "Historically, if you look at the [natural] gas entering the energy market, we always needed single users that use large quantities and then the domestic or small users follow. It will be a similar concept with hydrogen.

"The big consumers, like large CCGTs will absorb the considerable quantities that justify the investment in infrastructure, which will then bring the massive rollout of the hydrogen economy. It will not be the other way around where everyone thought it would start from hydrogen filling stations, for example, or households."

The Vattenfall Magnum power plant, owned and operated by Vattenfall, was originally conceived as an integrated gasification combined cycle (IGCC) plant. The plant design was based on the multi-fuel concept for generating power using a wide range of organic materials including coal, petroleum, and biomass.

Coal gasification technology was planned to be introduced in the second development phase of the project, which would have seen the units run on syngas derived from coal. The coal gasification project was, however, first postponed in 2011 and later abandoned in March 2016 due to economic and environmental concerns. The project's three units have, therefore, been operating on natural gas in combined cycle mode since 2014. Each unit consists of a gas turbine and a steam turbine provided by MHPS.

But with the determination still there to cut emissions, a memorandum of understanding for the development of a hydrogen-based carbon-free gas power generation project at the facility was signed between Vattenfall, Gasunie, and Equinor (formerly Statoil) in July 2017.

MHPS will provide its expertise to investigate the technical feasibility of hydrogen firing as gas turbine OEM.

Under the agreement, Equinor is responsible for hydrogen production by converting the Norwegian natural gas into hydrogen and carbon dioxide, while Gasunie is engaged in research for the transportation and storage of hydrogen at the power station. The CO_2 released during the hydrogen production process is planned to be stored in underground facilities off the Norwegian coast.

According to estimates, the conversion of one of the units to run on hydrogen is expected to cut CO_2 emissions by 1.3 million tonnes a year.

"If you do a rough feasibility analysis for the remaining lifetime of the plant, converting it to hydrogen is a feasible and logical choice," noted Professor Kakaras.

While MHPS was not able to discuss the project costs, it is possible that funding could come from several sources. As a first-of-a-kind project with a European dimension, the European Innovation Fund could have a role. The European Investment Bank has shown an interest and revenues from the ETS (European Emissions Trading Scheme) could also be available.

Although the project has received considerable publicity, it is still at the development stage and the Final Investment Decision (FID) has not yet been made.

MHPS says it is in a position to demonstrate consumption from the utilisation side and has all the information related to costing, timelines and availability of technology. The challenge is the supply side – a huge amount of hydrogen is required compared to what is available. By current estimates it would require half the capacity of the world's electrolysers, so it is not feasible for it all to come from electrolysers.

Although Vattenfall's long-term vision is to locally produce hydrogen through electrolysis using electricity from renewable sources, most of the hydrogen will therefore have to initially come from natural gas reforming.

In terms of technology, the main challenge will be in the gas turbine combustor. According to MHPS, sufficient work has been done to develop a new generation of combustor. "There has been years of research and development to deliver a new industrial scale combustor system," said Professor Kakaras.Typically these could operate with NOx emissions as low as 10-15 ppm.

MHPS has already successfully tested the burning of a stable fuel mix of 30 per cent hydrogen with natural gas in a technology for large-scale gas turbine, reducing its CO_2 emissions by 10 per cent. To move to 100 per cent hydrogen combustion, however, will take another round of development, which MHPS says it has nearly concluded.

Professor Kakaras added: "A practical way forward to the massive rollout of hydrogen into the existing systems, is to start with increasing the amounts of hydrogen together with natural gas.

"This means we could immediately have 30 per cent hydrogen in the mixture with minor modifications to current assets. And then when the infrastructure on the supply side becomes available, we can move to 100 per cent [hydrogen]."

Typically, to overcome the flame stability problem that burners experience at low NOx levels, today's conventional diffusion burners would have to be re-designed for hydrogen and hydrogen-rich fuels. This would enable them to accommodate the different Wobbe Indexes and heat release per unit volume of fuel while keeping NOx emissions low.

Looking at the timetable for commercial application, MHPS says it is ready to handle a wide range of hydrogen contents, thanks to the state-sponsored effort in Japan. With regards to burning 100 per cent hydrogen, it predicts that it will have multiple projects by the mid-2020s, leading to a rollout of hydrogen-fired gas turbines by 2030. The only potential delay to this would be due to the supply of hydrogen and the business case.

The gas turbine sector is certainly now firmly focused on the need to burn carbon-free fuel.

Following high interest from its members in hydrogen as an energy vector, the European Turbine Network formed a new Working Group on hydrogen in March. The goal of the Hydrogen Working Group is to enable and optimise the use of hydrogen and ammonia in gas turbines, by identifying and addressing potential barriers. The Working Group consists of representatives from OEMs, academia, utilities and service providers.

Activities such as this will be important if countries are to meet decarbonisation goals. Professor Kakaras concluded: "We will need to see carbon-free thermal projects by around 2040, so that means first-of-a-kind projects have to come 10 years earlier. We therefore need to see active involvement from players by 2020."

Junior Isles

Reading the tea leaves

If nothing else, the mix of speakers, delegates and tone of presentations at this year's Eurelectric Power Summit in Florence, Italy, again illustrated how fast the electricity sector is changing, and how far it has already come.

Perhaps the best summary of the progress that has been made was presented by Michael Liebreich, Chairman and CEO of Liebreich Associates, and Founder and Senior Contributor to Bloomberg New Energy Finance.

The first slide he showed was one he presented in 2015, which showed that global investment in renewable capacity and energy efficiency had reached an all-time high of $413 billion, growing from just $95 billion in 2004. Although investment fell to $384 billion in 2018, new capacity has continued to increase, hitting 179 GW last year.

"What we see is that the investment value has stalled at around $354 billion a year but the volume of installations has continued to increase… we're seeing one dollar in every six invested in energy going into clean resources. The reason why volume goes up while investment stalls, is because of the experience curve."

A snapshot of world records for clean energy prices globally showed that solar PV and onshore wind deals were signed in 2017 Mexico at $1.97 ¢/kWh and 1.77 ¢/kWh, respectively.

Cartoon: jemsoar.com

In Germany, meanwhile, in 2016 Dong/EnBW submitted a bid of 4.9 ¢/kWh for an offshore wind project to be built in 2024.

"The cheapest source of electrical power that you can add to the grid, country after country now, is renewable, is clean, is zero carbon," said Liebreich.

His figures showed that there have been almost five doublings of variable wind power in the generation mix since 2004 and almost nine doublings in the share of solar over the same period. This means there is an increasing amount of variable power coming on to grids around the world.

At the same time coal, which has been the stalwart of baseload power for decades, continues to fall off the grid. And while, gas fired generation is growing incrementally, it is not enough to replace coal. Like most industry observers, Liebreich believes that gas has an important role to play going forward but increasingly for flexibility only, i.e. to compensate for fluctuating generation from wind and solar. "The future is one of variable, very cheap renewable energy," he said.

In markets around the world, this has often resulted in more electricity production than is needed at points in time and oftentimes curtailment of wind power, in particular. But while some see this as a problem, Liebreich merely notes that over-generation is "a feature of these systems". The question, he says, is what do you do with excess renewable electricity that carries zero carbon cost?

Although the cheapest way to store power is through heat, e.g. with a hot water tank, most of the current focus is on batteries – whether via stationary storage, passenger electric vehicles (EVs), commercial EVs or electric buses. Global growth for batteries in all sectors, including consumer electronics, has indeed skyrocketed over the last four years. Liebreich showed that global demand has grown from less than 100 GWh in 2015 to around 250 GWh in 2019 and will hit 2000 GWh in 2030.

"The good news is there will be lots of batteries and that will help you a lot," he told delegates during his presentation, "the bad news, or not so good news, is that overwhelmingly they are going to be in vehicles. Stationary storage will be the minority."

The growth in batteries for vehicles is being driven by an EV market that is growing so rapidly, that BNEF expects that more than half of all new car sales in 2040 will be electric, compared with a couple of per cent today.

The move towards the electrification of transport, and indeed other sectors such as industry and buildings, is where things get interesting for the power sector. In its 'Decarbonisation Pathways 2018',

Eurelectric concludes that a major shift to electricity in transport, buildings and industry is needed to meet the goals set by the Paris Agreement. It notes that for the EU to reach full decarbonisation by 2050, electricity needs to cover at least 60 per cent of final energy consumption.

Commenting on developments over the last six or seven months and looking forward, speaking on the sidelines of the conference, Serge Colle, Global Power & Utilities Advisory Leader at EY, said: "In a world of full electrification, electricity production has to double. So the first thing we see is that it is becoming more and more of a reality that we will see more electrification and deeper electrification. But it's also about accelerating the speed of electrification… the danger is we need to go faster."

He added: "The second big topic for me is the DSOs (Distribution System Operators). They can be proud of what they've achieved so far but… they will have to accelerate their efforts to digitalise, not only the networks but also their businesses. Many are still counting on the resilience of their systems. There are a lot of good plans but they still lack an integrated plan to digitise the networks and the business."

Ahead of a planned information session at the conference, Paul de Wit, Senior Advisor of Regulatory Affairs at Alliander and Chair of the Working Group 'Institutional Framework', talked about the evolution of the DSOs since the Third Energy Package ten years ago, and the central role of DSOs. In order to reflect this central role at EU level, the recently adopted Clean Energy Package created a new European Association for DSOs, currently called the 'EU DSO Entity', which will be set up by DSOs in early 2021.

He said: "The DSO Entity is a new body for the DSOs to work together on network codes, cyber security, digitalisation, flexibility and collaboration [with Transmission System Operators] on things like data management and network planning. For example, in the Third Energy Package it was mainly the TSOs that wrote the network codes… but it put us in the situation that we were only one of many stakeholders in the whole process. This was not a comfortable situation for us because we had the same responsibility with regards to keeping the lights on and system security, etc. We therefore lobbied for the concept of the DSO as mutual market facilitator and emphasise that we have a big role to play in market facilitation."

The role of the DSOs will become much more important in light of the energy transition, and having a single association speaking with one voice for 2400 DSOs is an important step.

Dr Erik Landeck, Managing Director Stromnetz Berlin GmbH and Vice Chair of Eurelectric Distribution and Market Facilitation Committee, said: "Now we have the possibility to form a voice for all DSOs. Some steps have already been set – statutes have to be developed within one year; after that there will be consultations with the Commission and we will then be tasked with bringing the entity into existence. So right now we are in the first phase of drafting the statutes and financing rules."

Along with the progress being made by DSOs and the digitalisation of networks, investment in renewables and the electrification of transport and industries will be the hot topics to watch in the coming 12 months leading up to the next Eureletric Power Summit in Dublin, Ireland, next year.

Colle summed up his views on what's to come, saying: "It's going to be exciting to see how different industries continue to converge on our business. Reading the tea leaves, I see that the stars are lining up for acceleration. I am seeing a lot of things happening whereby there is a strong force of alignment that could potentially push for a more aggressive scenario than we have in the Paris agreement."