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Is nuclear dead?

Despite numerous setbacks and challenges, some argue the nuclear renaissance is far from dead.
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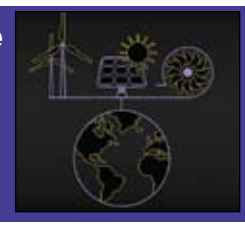

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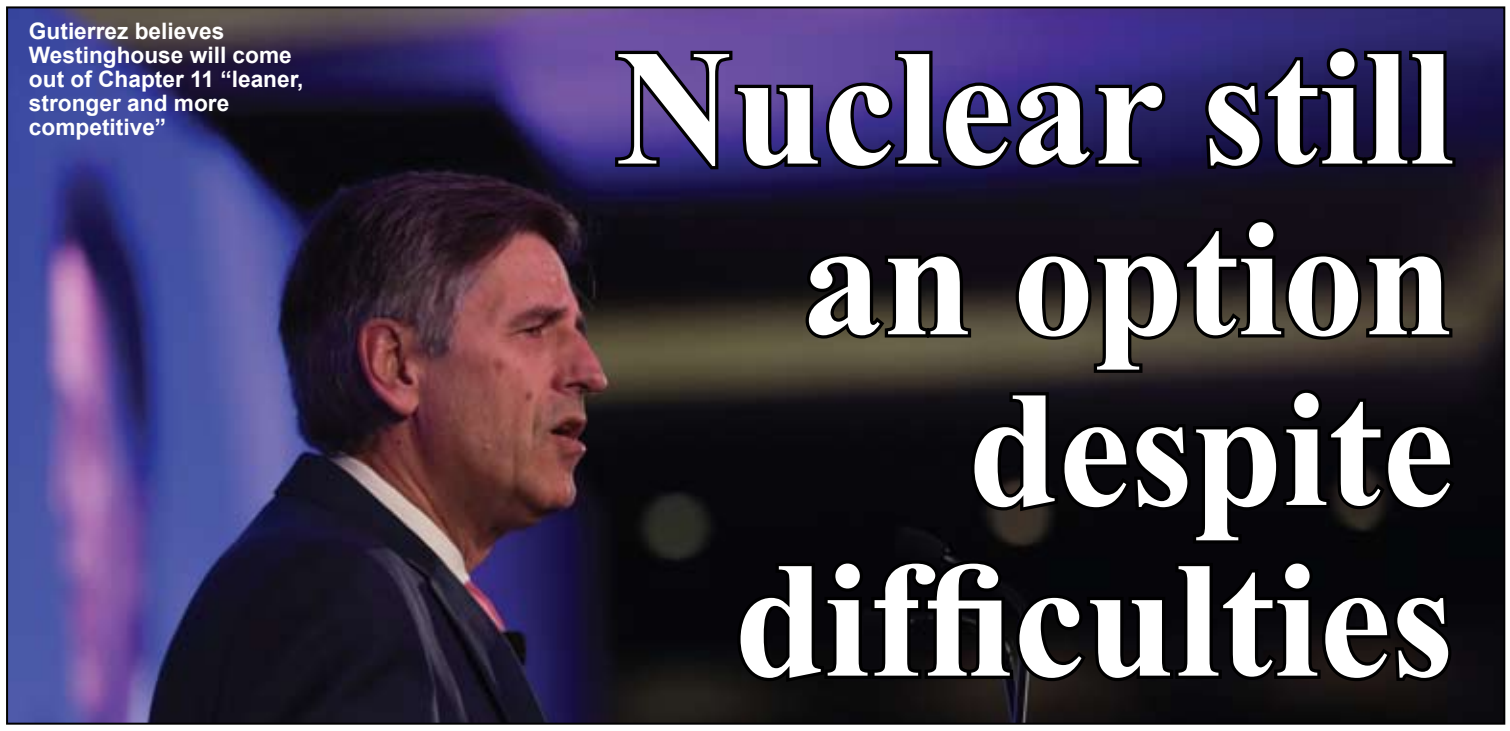

Gutierrez believes Westinghouse will come out of Chapter 11 "leaner, stronger and more competitive"

Nuclear still an option despite difficulties

Problems at projects in the US and Europe have not dampened the optimism of nuclear advocates. **Junior Isles** reports

Nuclear power must remain part of the energy mix, despite the ongoing challenges facing new build projects in several countries, say its supporters.

At this year's World Nuclear Association (WNA) conference in London, UK, Agneta Rising, the WNA's Director-General, presented the organisation's 'Harmony' report, stating that substantial growth in nuclear capacity is needed if the world is to meet its 2°C target for global warming.

The Harmony programme is aimed at delivering 1000 GW of new nuclear capacity by 2050. But while such nuclear additions may be needed to avoid the catastrophic effects of climate change, such a target appears ambitious given the challenges that new build projects continue to face.

The reactors being built at the Vogtle and VC Summer power stations were supposed to herald a renaissance for nuclear power in the US but have instead become reminders of the financial and technological problems afflicting the industry.

Further, the projects, intended to be the US showcase of the AP1000 reactors, have pushed technology supplier Westinghouse into Chapter 11 bankruptcy protection and caused a financial crisis at its parent company, Toshiba.

Speaking at the WNA conference, Jose Gutierrez, President and CEO, Westinghouse Electric Company, blamed the problems on regulatory issues, the delivery model used to engineer and procure the project, as well as the fact that the projects are using first-of-a-kind technology.

He added: "It's important to realise that the contracts were signed in the context of the nuclear renaissance… but it didn't happen. After that we were obliged to make some changes in the design because of new regulatory requirements. In 30 years we didn't have any nuclear construction projects in the US. That means we had a lack of recent knowledge and experience to support new build in the US."

However, Gutierrez remained optimistic that the company would come

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China has sights set on UK nuclear

China continued to demonstrate its ambitions to become a major force in the global power industry with confirmation that China General Nuclear (CGN) will bid for an equity stake in the troubled Moorside nuclear power project planned for Cumbria in the United Kingdom.

CGN, alongside another Chinese state-backed company CNNC, already shares a one-third stake in the Hinkley Point C power station in Somerset, which is being built by French developer EDF. This deal also involved a plan for the Sino-French partners to build a further plant at Bradwell in Essex using Chinese reactor technology.

The Moorside project ran into difficulty after US nuclear technology provider Westinghouse filed for Chapter 11 protection this year, following cost overruns at two prototype AP1000 reactors it is supplying in the US. Its Japanese parent, Toshiba, has since been engulfed by financial problems.

Moorside is being built by NuGen, originally a partnership between Engie of France and Japan's Toshiba. However, Engie pulled out when financial problems hit Toshiba following the Westinghouse bankruptcy. NuGen is now urgently seeking new backers for the £15 billion project.

CGN is the second Chinese firm, along with China's State Nuclear Power Technology Corporation, to join a growing list of foreign investors eyeing a stake in Moorside.

The UK is one of a number of countries being targeted for investment by Chinese power companies.

In September, China Huaneng Group, the nation's largest power producer, said it is planning to increase its overseas generation capacity by 60 per cent in three years, with a substantial portion in nations covered by China's Belt and Road Initiative, according to the chief of its Hong Kong unit.

Huaneng is the state-owned parent of Hong Kong and Shanghai-listed Huaneng Power International, which owns some of the most efficient plants of the group.

China Huaneng, which has a global generating capacity of 160 GW – roughly a tenth of China's total – has invested in plants overseas with a combined generating capacity of 10 GW since it was set up over three decades ago.

Huaneng Group Hong Kong General Manager Chen Xi said it aims to raise this to 16 GW by 2020. Chen noted that Huaneng commissioned 1.32 GW of coal-fired plants in Pakistan this year, meeting a quarter of the nation's power supply gap. It plans to commission a 0.4 GW hydropower project in Cambodia before year end and has projects either planned or under construction in Myanmar, Singapore and Australia.

Chen said this year has been a harvesting year for Huaneng in the Belt and Road countries but noted it has "faced plenty of challenges and difficulties". He said project financing and unforeseen circumstances are some of the tough tasks his company has faced.

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out of Chapter 11 "leaner, stronger and more competitive" and would be going back to its previous model of engineering and procurement to ensure a "realistic approach" to new projects.

But such project challenges have not been confined to Westinghouse and the US. Areva has also had to deal with massive delays and budget overruns with its new EPR reactors being built at Flamanville, France, and at Olkiluoto in Finland. In the UK, Hinkley C is already well over budget and behind schedule, while another proposed project at Moorside is facing difficulties caused by the problems at Westinghouse.

It was also recently announced that Fennovoima, the Finnish operator of a new plant to be built by Rosatom expects to receive a construction licence from local regulators in 2019 – a year later than its previous schedule. It is unclear whether this delay would affect the planned 2024 start-up date of the reactor.

Minna Forsström, Fennovoima's Project Director, remains convinced, however, that nuclear must remain part of the energy mix, despite the challenges the industry faces in building new projects to time and budget, especially in Europe where the cost of competing wind and solar continues to plummet.

"You have to keep in mind that different countries have different conditions, some have more wind and sun. In the northern countries, in January there are cold days when we have no sunshine and no wind. So we have to have base load from somewhere," she said. "And bearing in mind that we have to combat climate change, I fully support the Harmony programme that nuclear must be part of the package. I don't think we can afford to neglect a carbon-free solution in this package."

Commenting on how to overcome the problems of new build, Forsström said: "A nuclear project is like any other project but as it gets bigger in size, the rules of the game change. When you have projects that start going beyond €1-2 billion, you start having extra interfaces – you affect society, you affect the market, and there are many regulations.

"You have to ensure that the cooperation between the project partners is good and communication is transparent. The partners need to understand and solve problems before they get outside. You also have to take care of the other stakeholders as well – such as the regulators, NGOs – and also understand the implications for other local industries such as construction."

She also noted that although project developers are not necessarily over-ambitious on actual construction times, they might be over-optimistic on the time needed to finalise the paper work and agreements needed before construction can begin.

Finland is set to embrace a decarbonised future by increasing carbon taxes and introducing laws in 2018 that will begin to phase out the use of coal. Nuclear power could take up the slack as two new reactors are due to come online in 2018 and 2024.

In early September, the head of Finland's energy department, Riku Huttunen, told *Reuters* that the current strategy is to get rid of coal by 2030 and that the process will be started by legislation due next year.

Electricity industry has reached 'critical watershed', says DNV GL report

Profound changes set out in a recent report have significant implications for both established and new energy companies. **Junior Isles**

The entire electricity industry and its supporting infrastructure have reached a critical watershed, and dramatic changes are in progress, according to a new report from quality assurance and risk management company DNV GL.

Its '*Energy Transitions Outlook 2017*' report, released in early September, predicts that the next few years will be the last in which grids in industrialised nations are organised and operated in the same way as they have been for recent decades.

The prediction goes hand-in-hand with one of the report's other key forecasts, i.e., 85 per cent of global electricity production will come from renewable sources.

According to the study, electricity will increasingly be generated by different means, predominantly from renewables, and across all generation scales from massive offshore wind farms to domestic rooftop PV.

"New owners, users and traders will spring up, and the EV revolution is just about to start. By the end of our forecast period in 2050, the electricity system, its culture, and its personnel will be unrecognisable," the report states.

Large transmission network projects are likely to increase in number, thereby continuing the trend of connecting new centres of high energy demand with locations of significant generating capacity, including large renewables plants, sometimes a great distance away. These developments will include extended and strengthened transnational and national electricity interconnectors in regions such as Europe and Asia.

At the other end of the scale, much new generating capacity may be 'behind the meter', particularly for PV, producing power for on-site use at home or in business premises. Even on industrial or commercial sites, generating capacity per site may not exceed several hundred kilowatts, the study finds.

According to DNV GL, the results of its modelling have important implications for investors. Portfolios of network projects, some as small as residential installations, could become more significant than single large projects.

Investment horizons will reduce from the 12 to 20 years currently deemed appropriate. This change will also be seen in investments at residential, commercial and industrial scale, such as battery storage, or energy efficiency measures.

Commenting on the report, Remi Eriksen, Group President & CEO of DNV GL said: "As a company, we are highly exposed to the radical changes that will come to every part of the energy value chain, and it is critical for our customers and ourselves that we understand the nature and pace of these changes.

"The profound change set out in our report has significant implications for both established and new energy companies. Ultimately, it will be a willingness to innovate and a capability to move at speed that will determine who is able to remain competitive in this dramatically altered energy landscape."

Centrica increases distributed generation focus

Energy and services company Centrica is putting an increasing focus on distributed generation with the launch of Centrica Business Solutions, a new banner operating under Centrica's Distributed Energy and Power business.

According to the company, the proposition to non-domestic customers offers large energy users opportunities to harness the power of distributed energy solutions from one company. Centrica Business Solutions now has customers in 34 countries.

The business has also unveiled its vision for a cloud-based integrated solutions platform – a single portal that will give businesses full visibility and control of their energy estate including both proprietary products from Centrica and third party applications.

This new platform will be configured to the individual needs of customers and will allow them to interrogate data and control operations across their entire estate.

It will also give users the ability to see what benefits the addition of new technologies and approaches could bring, using their own data to assess the opportunity and calculate return on investment.

Jorge Pikunic, Managing Director for Centrica Distributed Energy and Power said: "Speaking to customers from a variety of sectors, it's clear that operational excellence and cost management are a key area of focus. We also know that they are looking for ways to improve their resilience and opportunities for growth.

"Energy can play an important part in helping them to tackle these issues but we understand it can be challenging to know where to start. By giving customers access to our in-house expertise, developing technology that keeps things simple, and helping them to join the dots between their assets, we will iron out the complexity and help them gain competitive advantage."

The growing interest in distributed generation saw Centrica's Distributed Energy and Power business recently announce the installation of one of the UK's largest commercial battery storage schemes for Gateshead Council.

The battery project has been designed to store or release energy for the Gateshead District Energy Centre in the north of England, which opened earlier this year, and will be capable of responding to any fluctuations in demand in under a second.

With a total capacity of 3 MW, the battery scheme is made up of six units capable of storing enough power to meet the needs of 3000 homes for one hour.

Once commissioned, Centrica will manage the project under a 10 year contract, providing various flexibility services for the grid which help keep the national electricity network in balance. In time, it will also be used to help meet peaks in local demand, providing electricity through a private wire to council-owned buildings and well-known Tyneside buildings including Gateshead College and the Sage Gateshead concert venue.

Climate change and renewables will continue to drive gas

Pressure to meet climate change targets combined with the rapid growth in renewables will secure the future of gas in the energy mix, according to experts at a recent meeting held in London, UK, by the International Gas Union (IGU).

IGU President David Carroll said that global greenhouse gas emissions have plateaued in the last three years largely due to reductions in both China and the US. He noted that US emissions fell by "a whopping 14 per cent" between 2005 and 2016, as coal fired power generation fell by 9 per cent due to replacement by cleaner, more efficient combined cycle plant.

He also said gas has a role to play, not just as a complement to renewables but as a renewable energy itself, through the conversion of waste, biomass, etc., to biogas.

The outlook for gas – which according to the IEA's July *Gas 2017* report is expected to grow by 1.6 per cent a year for the next five years – combined with growth in renewables is triggering numerous companies to reflect the importance of both energy sources in their strategies going forward.

Peter Mather, BP's Group Regional Vice President, Europe & Head of Country, UK said: "Producing oil and gas won't be enough… we are increasingly looking at projects that see us taking a role in decarbonising the future. BP has the largest renewables business of all the oil and gas majors."

The changing energy landscape has seen Norwegian oil and gas company Statoil become a significant player in the UK offshore wind market.

"We created New Energy Solutions, which is where the offshore wind business is," said Lars Troen Sørensen, VP – Head of Department, UK Government and Regulatory Affairs. "We are looking at other types of renewable energy but haven't started large investments in them yet."

Several power generators have also been forced to adapt their business models to reflect the growing amount of renewables. German energy giant E.On last year separated its fossil fuel assets into a new company, known as Uniper.

Despite the pressure on gas fired generation in the UK and Germany, Dr Felix Lerch, Executive Chairman at Uniper UK Ltd, remains optimistic on the outlook for gas fired generation.

"Under the coming coal consultation, the UK government expects to close the remaining coal fired power station by 2025. The government also wants to replace the ageing nuclear fleet but this will take time.

"Our gas fired power stations are in a very good position to provide security of supply in the UK and the rest of Europe. When coal and nuclear plants come off line and when renewables increase their role, we need modern flexible gas fired generation to fill the gap."

Eletrobras set for sale

■ Government could retain golden share ■ China keen on finishing Angra 3

Siân Crampsie

Brazil could net over $6 billion from the sale of state-owned power company Eletrobras, the government has said.

The surprise announcement sent shares in Brazil's largest power firm soaring as investors widely welcomed the implication of reduced government control over the energy sector.

Reports indicate that the government would reveal the exact nature and structure of the sale by the end of September, and that the sale could take place in 2018.

Privatising the firm would help to attract private investment to Brazil's electricity sector and will also facilitate a restructuring of Eletrobras, streamlining its operations and reducing debt.

The government is expected to retain some level of ownership in Eletrobras, including a possible 'golden share' giving it veto rights over key strategic decisions, Mining and Energy Minister Fernando Coelho Filho told a press conference in Brasilia. The sale is likely to involve the sale of new stock, and was "of fundamental importance" to the development of the Brazilian electricity sector, Coelho Filho added.

Rival power firms and international investors in Brazil's power sector have said they will be watching the sale process closely and examining any opportunities that arise for adding new assets to their portfolios.

Eletrobras' nuclear power unit, Eletronuclear, will remain in state hands, as well as some key large-scale assets such as the Itaipú plant, according to analysts. The firm's existing plans to sell off its seven distribution units as well as other non-core assets are on track, Coelho Filho said.

Eletrobras owns 14 subsidiaries that include power generation, transmission and distribution companies. It also controls the Brazilian half of the bi-national Itaipú hydropower plant, located on the border with Paraguay.

Eletrobras is responsible for 31 per cent of all electricity generated in Brazil, and owns a portfolio of nearly 47 000 MW. Its transmission lines extend over 70 000 km, covering all Brazilian states. Its net debt stands at over R23 billion ($7.26 billion).

Currently the government holds 40.98 per cent of Eletrobras' capital, while state development bank BNDES holds another 18.72 per cent. Years of mismanagement, political interference and an economic recession have left the company in a poor state of health, local reports say.

The sale is thought to be part of a wider economic reform programme being pushed through by Brazilian President, Michel Temer.

Last month Temer met with Chinese President Xi Jinping in Beijing to discuss and sign a memorandum of understanding covering nuclear energy cooperation between the two countries and the completion of the Angra 3 nuclear power plant.

Under the MOU, China National Nuclear Corporation (CNNC) will work with Eletrobras and Eletronuclear to promote the construction of Angra 3 and future nuclear power plant projects.

Construction of the 1405 MW reactor on the coast south of Rio de Janeiro started in 1984 but stalled two years later. Its completion is now scheduled for 2023, but Brazil does not have the estimated R16 billion needed to finish the job.

■ Enel Green Power Brasil Participações has started operating its 180 MW Delfina wind farm in Campo Formoso, Bahia state. The wind farm is Enel's largest in Brazil and its construction included the development of a 90 km-long transmission line.

DOE urges easing of power plant rules

A new report from the US Department of Energy says that the country's grid reliability is being undermined by environmental regulations as well as cheap natural gas.

The DOE believes that a combination of new rules covering licensing and permitting and low energy prices has made it hard for conventional plants to compete and resulted in the closure of assets that once formed the backbone of the grid.

The report recommends that the government makes the operation of power plants cheaper and easier, while Energy Secretary Rick Perry was keen to emphasize that the US should use all of its available energy resources.

Over the five years to 2015, over 42 GW of coal-fired capacity has closed in the USA, while over 55 GW of new solar and wind energy capacity has been brought on line. Some 40 GW of new gas-fired generating capacity has also been added.

The changing energy landscape has raised concerns that power supplies in the USA would become less reliable and resilient. It has also forced energy companies to examine and alter their business strategies and implement strategic changes.

The American Wind Energy Association (AWEA) said that it was important to determine how a portfolio of domestic energy resources can ensure grid reliability and resilience. "DOE's comprehensive report provides a number of valuable policy recommendations," said Tom Kiernan, AWEA CEO. "In particular, DOE's recommendations to value essential reliability services, which wind provides; to minimise regulatory barriers to energy production; and to accelerate infrastructure and transmission development are prudent and will help continue America's wind power success story."

Coal lobby group ACCCE said that the report showed that the USA's coal fleet was essential to a healthy grid. "A reliable and resilient electricity grid is essential for public safety and health, a sound economy, and national security," said ACCCE CEO Paul Bailey. "One of the biggest challenges is how to preserve the nation's coal fleet so it can continue supporting a reliable and resilient electricity grid."

Over 55 GW of solar and wind capacity has been brought on line

ITC ruling splits solar sector

■ Suniva and SolarWorld win trade case
■ SolarWorld ramps up production

The US solar industry has once again been split following a ruling by the US International Trade Commission (ITC) in a case brought by solar companies Suniva and SolarWorld.

The ITC has found in favour of Suniva and SolarWorld's complaint, which centred around allegations that imports of crystalline silicon photovoltaic (PV) cells have seriously damaged the USA's domestic solar cell and panel manufacturing industry.

The unanimous ruling means that the case will move forward to a remedy phase, in which the ITC will make recommendations for action to President Donald Trump. SolarWorld and Suniva have proposed placing duties on imported solar modules.

Abigail Ross Hopper, president and CEO of the Solar Energy Industries Association (SEIA), said the ruling was "disappointing" and would harm the USA's solar sector.

"Foreign-owned companies that brought business failures on themselves are attempting to exploit American trade laws to gain a bailout for their bad investments," Hopper said. "We expect to be front and center in the ITC remedy process, and in the administration's consideration of this deeply-flawed case."

According to ITC data, nearly 30 US solar panel producers ceased manufacturing operations from 2012 to 2016. During this period, global PV panel imports increased nearly five-fold. This surge was led by China, whose imports rose by more than 700 per cent.

SolarWorld said in September that it would "immediately" begin ramping up production and workforce numbers in light of the ruling.

"Our struggle has always been about keeping alive the pioneering US solar technology industry as well as its workforce, from Ph.D. scientists to line workers," said Juergen Stein, CEO and president of SolarWorld Americas. "With relief from surging imports in sight, we believe we can rev up our manufacturing engine and increase our economic impact."

Analysts believe that duties on imports will more than double the price of solar PV modules in the USA and dramatically alter the economics of US PV projects.

New rules prompt renewables investment

Argentina's Energy Ministry says that new market rules that enable private power purchase agreements (PPAs) could lead to up to $6 billion of new investment in the country's energy sector over the next three years.

The new rules allow large power users to meet their renewable energy obligations by signing PPAs directly with power generators, and will result in up to 4 GW of new renewable energy capacity being built, the Ministry added.

"Renewable power development today occupies a central place in Argentina's energy, political, social and economic agenda," said Sebastian Kind, Undersecretary of Renewable Energy at Argentina's Ministry of Energy and Mining. "We have settled long-term policies and we are witnessing the outcomes of such policies," he added.

According to the Global Wind Energy Council (GWEC), Argentina is seeing a boom in the development of renewable energy thanks to new government targets and the creation of a renewable energy auction system.

The next round of renewable power auctions, known as RenovAr 2, will take place in October, and is expected to lead to a further $2 billion being invested in the sector, GWEC said.

Argentina has set a target of eight per cent renewables in its electricity mix by the end of 2017 and 20 per cent by the end of 2025.

Large power consumers with annual demand of 300 kW or more are required to individually comply with these targets.

The targets are likely to result in the addition of 10 GW of renewable energy capacity in Argentina.

The country has so far held two renewable power auctions – RenovAr in October 2016 and RenovAr 1.5 in November 2016. Some 2.4 GW of new capacity was awarded through these two auctions.

India cooperates with Germany on renewable integration

India is looking to improve the integration of renewables to the grid through a recently signed technical cooperation agreement with German government agency, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

The agreement signed under the Indo-German Energy Programme – Green Energy Corridors (IGEN-GEC) – is aimed at improving the sector framework and conditions for grid integration of renewable energy.

Speaking at the signing, Piyush Goyal, Minister of State (Independent Charge) Coal, Power, New and Renewable Energy and Mines, said: "We are implementing phase one of the Green Energy Corridors… we already have around 9400 circuit kilometres of green energy corridors under implementation in India. It will entail an investment of close to $2 billion."

Goyal said India now has more than 34 solar parks, with a capacity of 20 GW and is looking to start a second phase of projects for another 20 GW next year.

In 2013, Germany agreed to provide concessional loans of up to €1 billion through KfW (German Development Bank). In addition, Germany will lend up to €10 million under technical assistance in forecasting, balancing, market design, network management and demand side energy efficiency, implemented by GIZ.

Contributions were further increased in 2015 and 2016 through concessional loans up to €400 million for transmission infrastructure. A loan of €7 million has also been provided for training activities in the photovoltaic solar rooftop sector and energy efficiency in residential buildings under technical assistance through GIZ.

India can raise its renewable energy use to meet a quarter of the country's total final energy demand by 2030 according to the findings of a report presented in August by the International Renewable Energy Agency.

Australia pushes renewables with storage

- Calls issued under A$150 million Renewable Technology Fund
- Queensland large-scale renewable energy auction attracts interest

Syed Ali

The state government of South Australia has unveiled three calls under its A$150 million ($119 million) Renewable Technology Fund. The fund was launched in March as part of the government's A$550 million energy plan. The first project supported by it is a 100 MW battery, the tender for which was won in July by Tesla.

The Renewable Technology Fund includes A$75 million in grant funding and A$75 million in loans or other forms of support. Through it, the state government is now looking for proposals for firming renewable generation, or more specifically adding storage or other equipment to existing or pending wind or solar developments in order to get increased inertia and system stability. The second call is for bulk energy storage, for instance pumped hydro, compressed air, thermal storage or virtual power plants. The government is also seeking proposals for bioenergy generating units.

The winners are expected to be announced before the Australian summer, which starts in December.

Australia's renewables push has been attracting considerable interest. At the end of August Queensland's acting energy minister Curtis Pitt said a 400 MW large-scale renewable energy auction attracted more than 200 companies.

The Renewables 400 programme is part of the state government's A$1.16 billion Powering Queensland Plan and follows on from its Solar 150 programme.

The first large-scale solar projects in Queensland have now come on-line and there are another 20 projects either commencing construction or finalising commercial arrangements. These projects will have an installed capacity of almost 1800 MW and will create around 2800 direct construction jobs in regional Queensland and boost investment by $3.4 billion.

With the Renewables 400 initiative, the government wants to secure up to 100 MW of energy storage before 2020.

Pitt said: "Under this new initiative, we will support companies wanting to build the next generation of large-scale renewable and energy storage projects in Queensland.

"We all agree that energy storage technology will play an important role in the transition to higher levels of renewable energy and we are keen to see the benefits of this new investment flow into the Queensland economy."

Pitt also announced that Energy Queensland's Energy Services division is partnering with GreenSync Pty to create Australia's biggest 'virtual power plant'. Pitt officially launched the virtual power plant a cloud-based, load control system created to manage extreme electricity demand during severe temperature events.

"This virtual power plant system will have a positive impact on the affordability, reliability and sustainability of electricity supply during these severe events," he said.

Elsewhere, the Victorian government has introduced legislation to enshrine its renewable energy targets in law and establish a reverse auction mechanism to build 650 MW of new projects.

The premier, Daniel Andrews, announced the Victorian renewable energy targets (VRET) of 25 per cent renewable energy by 2020 and 40 per cent by 2025 in June 2016.

If it can be negotiated past the upper house, the legislation introduced to parliament in late August will make Victoria the first state to enshrine both its renewable energy targets and its commitment to invest in renewable energy in law.

- Wirsol Energy Pty Ltd, heading the Australian strategy and operations within Wircon group, plans to start construction of the Wemen Sun Farm project in Victoria during Q4 2017. The 110 MW peak (MWp) solar park will occupy an area of around 770 acres and is scheduled to be connected to the grid mid-2018.

Vietnam proposes new wind tariff to attract investment

The Vietnamese Ministry of Industry and Trade (MOIT) is proposing a new wind feed-in-tariff (FiT) in a move to attract more investors to the market and help existing projects whose pre-feasibility reports have been approved by the MOIT come to fruition.

The MOIT has proposed that the government increases the FiT of wind power from onshore wind power plants to 8.77 cent from the current 7.8 cent per kWh. The existing FiT applies to two current projects in operation in Binh Thuan – Phu Lac and Binh Thuan No. 1 – but the MOIT believes that it will be difficult for these plants to recover their capital costs.

The Bac Lieu offshore wind farm receives 9.8 cents/kWh due to its location. The MOIT is now proposing a FIT of 9.97 cents/kWh for near shore wind projects.

Currently, there are 48 registered wind power projects with a total capacity of 5000 MW in Vietnam, 23 of which had their pre-feasibility reports approved by the MOIT and are waiting for an increase of the FiT.

The new rates, which would be applied until the end of 2020, are considered to be lower than the region's average.

The national goal for the development of wind power within the scope of the National Power Development Master Plan is to install around 800 MW of wind power by 2020, increasing to 6000 MW by 2030.

In August it was announced that the first turbines of the Dam Nai wind power project in the south central province of Ninh Thuan were installed in Ninh Hai and Thuan Bac districts. The 40 MW project consists of 16 wind turbines supplied by Siemens Gamesa.

The MOIT is also being urged to ramp up its solar efforts. The People's Committee of southwestern Tay Ninh province recently urged the MOIT to add 15 solar power projects to the provincial planning scheme on electricity development from 2011-2015, with a vision through 2020.

According to the committee, since June 2017, enterprises have asked for the province's permission to build 15 solar power plants, worth a total of VND15.4 trillion ($678.4 million). The projects have a designed combined capacity of 554 MW and will be implemented from 2017-2019.

Taiwan looks to enhance offshore wind construction

LOC Renewables, a part of LOC Group, a leading international marine and engineering consultancy, together with four other parties, has signed a Memorandum of Understanding (MOU) outlining their intention to work together to further offshore wind farm development and construction in Taiwan.

Together with the CR Classification Society, Taiwan Institute of Economic Research, Taiwan Electric Research & Testing Center and Electronics Testing Center, LOC will look to enhance the quality, safety and reliability of offshore wind farm construction in the South China Sea region.

Taiwan is keen to ensure that its offshore wind farms constructed in the South China Sea meet international standards on quality and environmental impact.

In September two wind farms off the Changhua County coast passed a review by the Environmental Protection Administration's (EPA) ad hoc committee, while seven failed due to their impact on marine life, fishing and shipping activities.

The nine projects – four pitched by Greater Changhua's Northwest/Northeast/Southwest/Southeast Offshore Wind Power Corp, two by Hai Long Wind Energy, and three by Hai Ding Offshore Wind Energy – were first reviewed on June 30, 2017.

UK backs new offshore wind farms

Costs have tumbled in the offshore wind energy sector thanks to investment in technology and supply chains. Greater long-term visibility over government policy is now needed to keep the momentum going, the industry says.

Siân Crampsie

The offshore wind industry has called on European governments to help the sector maintain its current growth and cost trajectories.

Industry association WindEurope says that more clarity is needed on policies and deployment targets post-2020 in order to give offshore wind energy developers the confidence to continue investing in project and technology programmes.

WindEurope's call followed the results of the UK's latest contracts for difference (CfD) auction, where offshore wind submitted record bids of £57.50 per MWh including the costs of grid connection.

The auction results showed an average 47 per cent drop in the cost of offshore wind since the UK's last CfD auction in early 2015 and will see 3.2 GW of new offshore wind energy capacity built in UK waters by 2022. The price drop has been hailed as the success story of a rapidly maturing industry.

"The remarkable results of this latest UK CfD highlight the great strides made by offshore wind in recent years," said WindEurope CEO, Giles Dickson. "In light of these latest price reductions, we call on the UK and other European governments to make ambitious commitments on future deployment volumes for offshore wind.

"To sustain these cost reductions the industry needs to be able to plan ahead, especially for the period post-2020 – crucially it needs at least three years' visibility on the timing and volume of auctions."

In Germany, a group of politicians and offshore wind industry companies have urged the federal government to implement more ambitious goals for the North and Baltic seas.

The group has signed the so-called Cuxhaven Appeal 2.0, challenging a 15 GW cap for offshore wind installed by 2030, and calling for new targets of 20 GW by 2030 and 30 GW by 2035.

Winning offshore wind projects in the UK auction were Dong's Hornsea Project 2, EDPR and Engie's Moray wind farm, and Innogy and Statkraft's Triton Knoll.

The 860 MW Triton Knoll wind farm will start operating in 2021 with a strike price of £74.75/MWh. The 1386 MW Hornsea 2 and 950 MW Moray project will follow a year later, with a strike price of £57.50/MWh.

Dong said that it was able to make the final investment decision for Hornsea 2 – the world's largest offshore wind farm – following the CfD results. It added that the drastic drop in price had been enabled by the scaling-up of both project sizes and wind turbine capacities.

Energy UK said that the UK's offshore wind sector had shown that "it can deliver". Energy UK CEO Lawrence Slade said: "This shows what can be achieved by providing the necessary certainty for investment… We now need the government to set out an ambitious, long-term plan for further decarbonisation in the Clean Growth Plan, as well as providing certainty around the timing for further auctions which allow for all technologies to compete for contracts."

The auction drew inevitable comparisons with the CfD strike price of £92.50/MWh for EDF's Hinkley Point C nuclear power project, and also raised concerns about the profitability for offshore wind projects.

There were also concerns about the impact of the auction on other renewable energy technologies that are in the same auction 'pot' as offshore wind, but cannot compete on price.

Atlantis Resources said it was unsurprised not to have won a CfD contract for its MeyGen tidal energy project in Scotland. However it believes there is a possibility of it entering bilateral discussions with the UK government over a CfD contract, or of there being a separate marine energy 'pot' in the next CfD round.

Drax planning new gas and energy storage

One of Europe's largest coal-fired power stations is continuing to reinvent itself as a clean, flexible source of energy for the UK market.

The Drax power station has outlined plans for the construction of a large-scale battery energy storage facility as well as a project to repower some of its existing units to fire natural gas.

The 4 GW power plant in Yorkshire, northern England, has already converted three of its six coal-fired power units to biomass firing, and is considering converting a fourth.

Its latest plans would see the conversion of two more units into a 3.6 GW gas fired combined cycle power plant that would dwarf the UK's current largest gas unit – the 2.2 GW Pembroke power plant in Wales.

It also wants to build up to 200 MW of battery energy storage to provide grid support services to the UK market. A final investment decision on the projects would depend on the firm winning a capacity market contract, it said.

"Drax power station is a national asset and a significant driver of economic growth in the North of England," said Andy Koss, CEO of Drax Power. "These options could repurpose up to two of our coal assets and extend their operation into the 2030s."

Koss added: "We are at the start of the planning process but if developed these options for gas and battery storage show how Drax could upgrade our existing infrastructure to provide capacity, stability and essential grid services, as we do with biomass. This would... help to deliver government's commitment to remove coal from the UK grid."

The UK government announced its intention to phase out coal-fired generation by 2025 and earlier this year held a consultation on these plans.

Paks set for 2018 kick-off

Work on a fifth unit at Hungary's Paks nuclear power plant will start in January 2018, Prime Minister Viktor Orban has said.

The project has been delayed by legal challenges brought by the EU to contracts and financing arranged by MVM Paks Nuclear Power Plant but construction of the €10 billion project is ready to go ahead, local reports indicated.

The two 1200 MW reactors at the Paks site, 100 km south of Budapest, will be largely financed by Russia and will consist of Russian VVER reactors. The European Commission approved the Paks project in March 2017 after judging that it met EU rules on state aid "on the basis of commitments made by Hungary to limit distortions of competition".

The European Commission has also investigated the contract between MVM Paks and Rosatom because of concerns that it did not meet public procurement standards. It cleared that investigation in 2016.

Neighbouring Austria has also expressed concerns about the safety of the proposed project.

The new Paks units could start operating in 2023 if construction gets under way in 2018.

ESB begins offshore wind push

- 1 GW plans for Irish Sea
- Project contractors sought

Ireland's ESB has signalled an effort to push into the offshore wind energy sector with the launch of tenders to find contractors for its plans.

The state-owned utility is looking at developing up to 1 GW of offshore wind energy and is calling for expressions of interest for a framework agreement with a provider of renewable energy marine services related to offshore wind farms.

It is also seeking companies to provide ecological consultancy services related to offshore wind farms.

In a tender notice issued in early September, ESB said it plans to develop or acquire offshore wind farms starting in 2018, via a pipeline of projects that are now in the consenting process. The projects are expected to be between 200 MW and 500 MW or more in size, and located in the Irish sea, around Ireland and the UK.

The notice said ESB was seeking a provider of renewable energy marine services including geotechnical investigation, Lidar deployment, site characterisation assessment and risk assessments and method statements development, among others. Post construction services could also be included.

A second tender notice, issued later in September, seeks services such as terrestrial and marine habitat surveys, environmental and ecological impact assessment work, habitats regulation assessment, consultation with stakeholders, giving witness evidence at hearings and site supervision.

South Africa reports progress on PPAs

Developers will have to renegotiate power purchase prices for projects awarded in 2015, the government says.

Siân Crampsie

A dispute between South African utility Eskom and renewable energy developers could be resolved by the end of October, paving the way for delayed projects to go ahead.

The country's energy minister, Mmamoloko Kubayi, has said that power purchase agreements for 26 large-scale projects would be signed by 28 October. The government has recommended a price ceiling of 77c/kWh for the contracts.

The signing of the PPAs will depend on the developers coming to an agreement with Eskom and the Department of Energy over price.

The 26 projects were awarded development rights in rounds 3.5 and 4 of South Africa's Renewable Energy Independent Power Producer Programme (REIPPP) in 2015.

Despite winning contracts in the competitive auction process, developers later found that Eskom would not conclude the PPA deals, citing a lack of grid capacity and the costs of connecting new generators. Developers will now have to consider the implications of renegotiating the price of their power deals, according to the South African Photovoltaic Industry Association (SAPVIA).

The South African Wind Energy Association (SAWEA) welcomed the announcement about the contracts, as it gives IPPs some clarity over the future of their projects. It indicated, however, that forcing developers to renegotiate the terms of licenses won in a competitive auction was illegal.

SAWEA said: "This condition, which requires tariff negotiating, is illegal in the Renewable Energy Procurement Programme's rules. SAWEA is looking to the minister for guidance as to how this condition will be imposed."

SAPVIA says it will support the decisions of the individual preferred bidder IPPs once they have evaluated their positions. "We believe the majority of the IPPs are willing to offer more value and engage openly and honestly with the Department of Energy and the independent power producers' office regarding the minister's statement, but ultimately the decision lies with each of them individually," said SAPVIA programme manager Niveshen Govender.

SAPVIA added that developers would need to consider the implications of accepting a lower price, the legitimacy of the process and the risk of legal challenges.

The 26 projects have a combined value of R50 billion ($3.7 billion) in investment, said SAWEA.

According to the government, the renegotiation will assist in reducing the requirements for additional government guarantees that would impact negatively on the current economic climate.

Egypt builds renewable capacity

Egypt is expanding its solar energy capacity with the help of multi-lateral lending institutions.

The African Development Bank (AfDB) has agreed to fund three solar power plants in Egypt's Aswan region, while the Asian Infrastructure Investment Bank (AIIB) has approved a loan to finance new solar photovoltaic (PV) capacity in the country.

AfDB said it would lend $55 million to each of three 50 MW solar PV plants located in the 1.8 GW Benban solar complex.

The three 18-year senior loans will back the Alcazar I, Delta and Shapoorji Pallonji projects, which are expected to reach financial close by the end of October 2017 and be operational by the end of 2018.

The projects are part of the second round of Egypt's feed-in tariff (FiT) programme, which aims to diversify the country's energy mix.

The AAIB deal will support 11 greenfield solar projects with an aggregate capacity of 490 MW, the bank said. It is lending $210 million to the projects.

"Investing in clean, renewable energy is a big part of our strategy to promote a sustainable and low-carbon future for Asia," said D.J. Pandian, Vice President and Chief Investment Officer, AIIB. "We are supporting this project because it contributes to Egypt's renewable energy capacity, and it will help position the country as a regional energy hub, which will have economic benefits for the entire region."

In August, ACWA Power signed agreements to build three solar power plants in the Benban complex, as part of the second round of the FiT programme. The three solar farms have an aggregate capacity of 165.5 MWp and a total investment value of $190 million.

Saudi Arabia shortlists wind bidders

The first utility-scale wind farm in the Kingdom of Saudi Arabia is taking shape with the shortlisting of 25 companies that have qualified to bid for the project.

Saudi Arabia's Renewable Energy Project Development Office (REPDO) has qualified the bidders for the 400 MW Dumat Al Jandal project, which will form a key part of Saudi Arabia's National Renewable Energy Programme (NREP).

The qualified firms – which include GE, Siemens, Marubeni and Mitsui, – will proceed to the Request for Proposals (RFP) stage as either managing members or technical members or both, based on their experience in delivering independent power producer (IPP) projects of this scale, the Saudi energy ministry said.

Bidding for the wind power project is set to close in January next year. It is the second of two tenders in round one of the NREP, the first being a 300 MW solar PV project in Sakaka.

China and UK collaborate offshore

China and the United Kingdom are to work together to develop the next generation of offshore renewable energy technologies.

Researchers from both countries have signed agreements to collaborate on five projects covering tidal, wave and offshore wind systems. The three-year long projects will use environmental science, technology and engineering to tackle key challenges affecting the development of offshore systems.

The projects will determine where the best energy resources are available and where would be the best loation to implement the technologies, and inform the development of technology so that structures are resilient to extreme events such as typhoons and earthquakes.

They will also focus on the advancement of virtual prototyping in the design and optimisation of offshore renewable energy power take-off (PTO) systems, and on tackling challenges related to the integration of different offshore technologies into multi-purpose platforms.

The Engineering and Physical Sciences Research Council (EPSRC) and the Natural Environment Research Council (NERC) are supporting the projects with just over $1.5 million of funding, which will be distributed from the Newton Fund. The National Natural Science Foundation of China (NSFC) is providing support for all of the projects.

The projects have been funded as part of the Joint UK-China Offshore Renewable Energy programme.

NERC's Chief Executive, Professor Duncan Wingham, said: "This research will develop the potential of offshore renewable energy technologies, integrating environmental science to provide a better understanding of the energy resources, the sustainable development of ORE systems and where best to locate and deploy these systems to ensure a stable power supply with minimal environmental impact."

Solar future bright in Iran

One of the world's largest solar power plants is set to be built in Iran after a UK-based green investment company sealed a deal with the Iranian energy ministry last month.

Quercus has set out plans for a 600 MW facility in central Iran, and said that the €500 million deal indicated that the country was "open for business". The project will be Quercus' first investment outside Europe and will form an important part of Iran's renewable energy plans.

Quercus' CEO, Diego Biasi, said that Iran represents a huge opportunity for renewable energy developers. "Iran is seeing unprecedented levels of investment since the lifting of international sanctions," he said.

Iran is aiming to install 5 GW of renewable energy by 2020 and solar irradiation levels make solar energy an obvious choice. Earlier this year Germany's Athos Solar connected a 14 MW PV facility to the grid in Kerman province, while Iranian PV developer Mokran has installed a 20 MW plant in the same area.

Details of Quercus' plans have not been revealed, but the firm said it was aiming to complete the project in 100 MW phases over a three-year period.

Reuters reported that construction could start in 2018.

The Iranian government says that installed solar energy capacity in the country now stands at 53 MW, and that deals for a further 932 MW of new capacity have been signed.

In August, Iran's deputy energy minister for planning said that a total of 3500 MW of new electricity generating capacity would be added to the grid by mid-2018.

The capacity additions will bring installed capacity in Iran to 81 000 MW, Hamidreza Azimi told the *Islamic Republic News Agency* (IRNA). "The new capacity is expected to help the ministry avoid periodic outages during the hot summer when demand peaks for cooling homes and businesses," said Azimi, adding that consumption was expected to rise by three per cent in 2017, but has soared by 10.5 per cent so far in the current fiscal year [started 21 March 2017].

Siemens JV closes cyber attack gap

A new partnership between Siemens and PAS Global is aiming to help energy companies overcome the "visibility gaps" in their asset portfolios that can heighten the risk of cyber attacks.

The two companies have signed an agreement to provide companies operating in the oil and gas and utilities sectors with fleet-wide, real-time monitoring solutions for their control systems.

The solutions will enhance the security of energy assets by providing the deep analytics needed to identify and inventory proprietary assets as well as the visibility to detect and respond to cyber attacks.

According to research conducted by Ponemon Institute on the state of cyber security in the US oil and gas industry, deployment of cyber security measures is not keeping pace with the growth of digitalisation in oil and gas operations. Meanwhile, critical infrastructure assets such as power plants and networks are being increasingly targeted by hackers.

"Utilities and the oil and gas sector confront sophisticated, persistent and aggressive cyber threats in the operational environment. Enhanced fleet-wide visibility is critical to detecting attacks and anomalies at the earliest possible stage," said Leo Simonovich, Siemens Vice President for Global Cyber Security. "With Siemens' deep operational monitoring expertise and PAS' leadership developing solutions to protect industrial control systems, this partnership is singularly positioned to provide essential visibility, build a mindset of perpetual vigilance and ultimately strengthen the energy industry defences."

PAS specialises in solving operational and security challenges for chemical, refining and power companies. Its Cyber Integrity solution provides foundational inventory management that covers all the major cyber assets found in plants today. The solution detects new or missing devices, aggregates configuration data at the asset level, baselines security-related data to monitor for change, and captures system interdependencies.

"With smarter, integrated automation comes a difficult challenge that has repercussions from the boardroom to facility operations: ICS cybersecurity," said Eddie Habibi, founder and CEO of PAS Global. "It is generally well understood that you cannot secure what you cannot see. That is why accurate, up-to-date visibility of system inventory is a fundamental element of any cyber security solution."

Uniper cool on Fortum deal

Fortum has its eyes on Uniper's 40 GW European portfolio but the German spin-off wants to retain its independence.

Siân Crampsie

Uniper appears set on rejecting a takeover approach made by Fortum in spite of assurances by the Finnish company that it would be "a constructive strategic partner" to the firm.

Fortum has made a formal offer to purchase all of Uniper's shares from E.On at a value of €22 per share. It has also reached an agreement with E.On under which the German firm will tender its 46.7 per cent shareholding in Uniper early next year.

Uniper, the spinoff created by E.On in its 2016 restructuring, says that the approaches made by Fortum are "clearly not in line with the strategy of Uniper". It added in a September statement that it was not in discussions with either Fortum or E.On concerning any transactions.

Fortum's proposal values Uniper at just over €8 billion. It says that the offer would enable Uniper shareholders to realise significant value created by market speculation of a takeover offer since May this year.

"The offer would be an attractive opportunity for Uniper shareholders to capture the full value of their investment," said Pekka Lundmark, Fortum's President and CEO. "Uniper shareholders could lock in the significant share price gains related to a significant degree to the prolonged takeover speculation in recent months."

Lundmark told *Reuters* in early September that Fortum was looking to spend cash on acquisitions in Europe that would complement its existing power portfolio. The Finnish company is cash-rich thanks to the sale in 2015 of its Nordic electricity grids for about €9 billion.

A takeover of Uniper would add almost 40 GW of installed capacity to Fortum's portfolio, including hydropower, coal, gas and nuclear assets. "The transaction currently under discussion is grounded in a strong strategic and financial rationale," Fortum said in a statement. It added: "Uniper's businesses are well aligned with Fortum's core competencies, are close to Fortum's home markets and are highly cash generative".

"Uniper's stated role as the provider of security of supply would be an excellent match with Fortum's ambition to accelerate the energy transition with increasing renewable generation and innovative solutions. Both are needed to make the change happen and each plays a crucial part as Europe transitions from a conventional to a cleaner and more secure energy future," said Lundmark.

Fortum also confirmed that it previously made a proposal to Uniper's management for a full takeover, a move that prompted Uniper to reitierate its intention to remain independent.

"We intend to be a long-term investor in Uniper and we take our responsibility to all stakeholders very seriously," said Lundmark. "We are convinced that a close cooperation of the two companies would render significant benefits for all stakeholders as there are many strategic and operational touchpoints between the portfolios of Fortum and Uniper. We hold Uniper management in high regard and, if a transaction is agreed with E.On, are looking forward to discussing with Uniper management how our commitments can be adequately formalised."

Total seals new green ventures

- EREN deal marks move into wind
- GreenFlex adds to efficiency plans

Total is planning to accelerate the expansion of its clean energy business with two new ventures.

The French oil giant has purchased a stake in EREN Renewable Energy for €237.5 million and acquired GreenFlex, a French firm specialising in energy efficiency.

EREN RE has over 650 MW of renewable energy capacity under construction or in operation globally, and has plans to expand its portfolio to 3 GW within the next five years. Total's decision to invest in EREN's recent capital increase marks the oil firm's move into the wind power market, it said.

"Total integrates climate challenge into its strategy and is pursuing steady growth in low-carbon businesses, in particular in renewable energy," said Patrick Pouyanné, Chairman and CEO of Total.

EREN said that the investment by Total would enable it to cover its financing needs for its planned expansion programme.


Total is looking to achieve 5 GW of installed capacity in five years

Philippe Sauquet, President of Gas, Renewables & Power at Total said that the EREN deal, which also gives Total the option of taking control of EREN after five years, is a major step in its plans to achieve 5 GW of installed capacity in five years. "In line with the group's integrated strategy along the oil and gas value chains, we are rebalancing our portfolio in renewables between the upstream manufacturing with SunPower and the downstream power production with EREN RE."

In a September statement, Total said that its acquisition of GreenFlex would accelerate the expansion of its energy efficiency offering. It intends to offer its customers integrated solutions, from optimisation of energy needs and sources and finding financing solutions to energy management and emissions measurement and reduction.

"Climate challenges are integrated into Total's strategy, and our aim is to be the responsible energy major. This acquisition in energy efficiency services is fully aligned with this strategy," said Sauquet.

Wärtsilä rolling with the waves

- Adds to sustainable technology portfolio
- Turnkey contracts anticipated in 2018

Finland's Wärtsilä is hoping to exploit "the largest untapped renewable energy source" after signing a global cooperation agreement with AW-Energy.

The deal covers the sales and delivery of AW-Energy's WaveRoller device to proposed commercial wave energy projects around the world.

It follows recent moves by Wärtsilä to expand into solar energy and energy storage technologies as part of a wider strategy to enhance its portfolio of sustainable energy technologies. The firm sees ocean energy as having the potential for hundreds of GWs of installed capacity globally.

"In addition to the vast resource potential, ocean waves and sea states can be accurately predicted up to days in advance, making it the long awaited addition in the next generation energy mix," Wärtsilä said in a statement. "Thus, the emerging wave power technology has all the pre-requisites to take an equally sizable and important role with solar and wind in the future."

AW-Energy's WaveRoller technology is involved in ongoing project developments in Europe, Asia and the Americas with a development pipeline of around 300 MW. "Cooperation with a world-class technology group like Wärtsilä demonstrates the commercial readiness level of our technology and positions AW-Energy as the front-runner in the supply and development of wave energy technology," said John Liljelund, CEO of AW-Energy.

The cooperation agreement will focus primarily on turnkey project deliveries and the two companies are already working to identify opportunities. Contracts could emerge in 2018, they said.

There is also potential for further cooperation between the companies in other fronts such as technology and lifecycle services, Wärtsilä said.

Americas

True Green orders Sunpreme modules

US solar company Sunpreme Inc. has unveiled a contract for the delivery of up to 150 MW of bifacial double glass photovoltaic (PV) modules to energy infrastructure asset manager True Green Capital Management LLC (TGC).

The master supply agreement calls for the delivery of Sunpreme's 380 W, 400 W and 420 W direct current (DC) modules over a period of three years.

TGC recently brought online a 16.5 MW rooftop solar plant for the Los Angeles Department of Water and Power (LADWP). The company has also raised $350 million (€293 million) from its True Green Capital Fund III LP targeting commercial and industrial solar projects in the USA.

Siemens Gamesa to repower NextEra units

Siemens Gamesa Renewable Energy (SGRE) has been selected by NextEra Energy Resources to repower two wind farms in Texas.

The two wind farms currently feature Siemens SWT-2.3-93 model turbines. The repowering programme will upgrade them to the SWT-2.3-108 model, enabling the delivery of up to 25 per cent more energy.

The project is expected to be completed by the end of 2017.

Bechtel to complete Vogtle 3 & 4

Georgia Power has selected Bechtel to complete the construction of the Vogtle 3 & 4 nuclear power plants near Augusta, Georgia, USA.

The two plants will be the first new nuclear power units to be built in the USA for three decades. Bechtel will take on a wide rage of responsibilities, replacing Westinghouse as the main contractor following the latter's bankruptcy.

Bechtel will be responsible for day-to-day construction activities through to completion of the project under the management of Southern Nuclear, the Southern Company subsidiary which operates the existing two units at Vogtle.

Asia-Pacific

Siemens Gamesa secures 300 MW in China

Siemens Gamesa has secured one of its largest orders for wind turbines in China with a 300 MW agreement for the Xilinhot complex in Inner Mongolia.

Siemens Gamesa is to supply 150 of its G114-2.0 units for the wind farm, which is expected to start operating in late 2018. It has also signed a long term service agreement for the turbines, it said.

Toyo wins Imaki contract

Japan's Toyo Engineering Corp is to build a 42 MW solar photovoltaic (PV) plant in Iwaki City, in Japan's Fukushima Prefecture.

Toyo has been awarded the engineering, procurement and construction (EPC) contract for the plant by local firm Pacifico Energy Iwaki GK. The plant is scheduled to commence operations in 2019.

Japanese utility Tohoku Electric Power Co will be the sole purchaser of the facility's output. Toyo affiliate, TAG O&M Services Corporation, will be in charge of the operation and maintenance (O&M) services.

SP orders Bhola plant

GE has been selected by the Shapoorji Pallonji Group (SP Group) to supply the power generation equipment for a new 220 MW combined cycle power plant in the Bhola district of Bangladesh.

SP Group is developing the Bhola project as an independent power producer (IPP), and has signed a 22-year power purchase agreement (PPA) with BPDB. The natural gas-fired plant is due to start operating by the end of 2019.

GE Power will supply the full suite of engineered equipment package (EEP) for the project, including two 6F.03 gas turbines, two heat recovery steam generators (HRSG), one steam turbine generator, condenser and associated control systems. GE will also provide technical expertise during the installation phase of the project.

Bergen delivers in Bangladesh

Rolls-Royce Power Systems subsidiary Bergen Engines has signed contracts for the delivery of two power stations to Bangladesh.

The firm will provide Confidence Power Rangpur Limited and Midland East Power Ltd with engines that will add a total of 262 MW of capacity to Bangladesh's grid. Within the contracts are also spare parts deliveries over 15 years.

These contracts are part of the Bangladesh government's ambitious plan to more than double national power generation capacity to 38 000 MW to meet a forecast demand of some 33 000 MW by 2030.

Vestas grabs 100 MW in India

Vestas has secured an order to deliver 100 MW of turbines to a project in India.

The deal calls for the supply, installation and commissioning of 50 units of the V110-2.0 MW turbine model and the provision of civil and electrical works on the project.

The Danish firm expects to start delivering the equipment at the end of this year, while the wind farm is planned to be commissioned by the first half of 2018.

Fengning orders Andritz units

International technology group Andritz has received a contract from a Chinese state-owned energy company for the supply of two variable speed pump turbines for the new Fengning pumped storage power plant in Hebei Province.

Under a €70 million contract from Fengning Pump Storage Co. Ltd., Andritz will supply two pump turbine motor generator units with variable speed and a nominal capacity of 330 MVA in generator mode and of 345 MVA in pump mode. Additionally, AC-excitation, governor, as well as protection and computer control systems will be supplied.

The Fengning pumped storage hydropower plant will be the largest plant of its kind in the world when operational. It will be equipped with twelve 300 MW pump turbine units in one cavern.

Europe

ABO inks framework agreement

Siemens Gamesa and ABO Wind have signed an agreement for the supply of wind turbines for projects planned in the German states of Hesse, North Rhine-Westphalia, Thuringia and Brandenburg.

ABO has selected Siemens Gamesa as the preferred supplier for the projects and is planning to deploy a total of 31 wind turbines at the sites. It will use Siemens Gamesa's SWT-DD-142 and G132 wind turbine models at the wind farms.

ABO is aiming to get the wind farms on line by 2020.

Wärtsilä improves Minersa

Wärtsilä has renewed its contract with Minerales y Productos Derivados SA (Minersa) to increase the efficiency, lower emissions and improve the safety of their power plant in Asturias, Spain.

Under a four-year maintenance agreement, Wärtsilä will optimise the performance of the 4.5 MW baseload power plant, which supplies energy to the local mining industry.

The scope of the agreement also includes upgrading of the control systems for two Wärtsilä 25SG gas engines.

Triton Knoll selects MHI Vestas

Triton Knoll has selected MHI Vestas as its preferred turbine supplier for its 860 MW offshore wind farm in the UK North Sea.

Triton Knoll – a joint venture between Statkraft and Innogy – says it plans to use MHI Vestas' V164-9.5 MW units for the wind farm, construction of which could start in 2018. The project was recently awarded a contract for difference (CfD) by the UK government.

The wind farm will use 90 MHI Vestas turbines. A final investment decision on the project is planned for 2018.

NEC to deliver 18 MW battery

Japan's NEC Corp is to deliver an 18 MW/7.5 MWh energy storage system to Swiss utility Elektrizitaetswerke des Kantons Zurich (EKZ).

The facility will be constructed at an existing substation in Volketswil municipality, near Zurich, and will be the largest of its kind in Switzerland. It will start operating in early 2018, NEC said.

Siemens drops AD8

Siemens Gamesa is to stop production of its 8 MW AD8 offshore wind turbine as part of plans to deliver an 8 MW turbine model to the market.

The wind energy firm will focus its efforts on the D8 model, an 8 MW-class direct drive wind turbine. The D8 will be installed at two projects in France: Dieppe-Le Tréport and Yeu-Noirmoutier.

The French authorities have approved Siemens Gamesa's decision to switch to the D8 for the two wind farms, it said. Its decision will have no impact on plans by Adwen, its offshore wind energy subsidiary, to build two factories in Le Havre, one for nacelles and one for blades.

International

GE to build Egypt PV plant

GE has won a turnkey order to build a 50 MW solar photovoltaic (PV) power plant in Egypt for FAS Energy.

The plant will be constructed under the Egyptian government's solar feed-in tariff (FiT) scheme, designed to boost the development of solar energy capacity in the country. The contract is GE's first full turnkey agreement for a solar power plant, it said.

GE will provide 4.4 MW solar skids featuring GE's LV5 1500 V solar inverters. It will also procure the complete plant assets such as solar modules, trackers and cables, provide the integrated system solution to the customer and be responsible for the civil, mechanical and electrical works.

Hitachi Zosen Inova to Istanbul WTE plant

Hitachi Zosen Inova is to build Istanbul's first waste to energy (WTE) plant after signing a contract with Istanbul Metropolitan Municipality (IMM).

The new plant will consist of three incineration lines burning municipal solid waste and generating around 70 MWe net. Beside the design and construction, the contract also covers the operation and maintenance of the turnkey plant for at least one year.

Hitachi Zosen Inova will partner Turkish construction firm Makyol to execute the contract. The WTE facility will start operating in 2021.

MHPS to supply Serbian FGDs

Mitsubishi Hitachi Power Systems, Ltd. (MHPS) is to provide Serbia's Nikola Tesla A coal-fired power plant with a flue gas desulphurisation (FGD) system.

The FGD system will reduce sulphur dioxide (SO_2) and particulates emissions from the 1720 MW power plant to meet EU environmental standards and support Serbia's future accession efforts. It will be one of the largest FGD systems in the world, MHPS said.

MHPS will supply two 650 MW FGD systems for installation in units 3 through 6 at the power plant, located 40 km southwest of Belgrade. MHPS will serve as leader of a consortium together with Itochu Corporation and MPP 'Jedinstvo' a.d. (JDS), a Serbian construction firm.

MHPS will be responsible for project management, design, supplying main systems and dispatching technical advisors for installation. The FGD system will cut SO_2 emissions by 97 per cent and will start operating in 2021.

Ambarli A set for control retrofit

Emerson has been selected to retrofit outdated controls at the Elektrik Uretim A.S. (EÜAS) Ambarli A combined cycle power plant in Istanbul, Turkey.

Ambarli A consists of three 450 MW power blocks, each in a 2x2x1 configuration, with a total generating capacity of 1350 MW. Replacing the ageing control system will improve the plant's reliability, Emerson said.

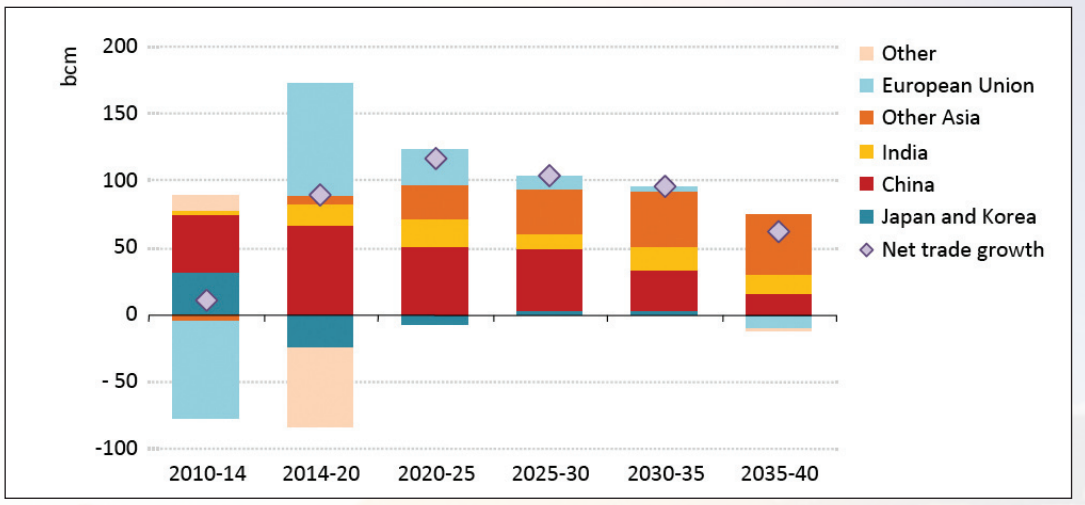
Under a contract awarded by government-owned Temsan, Emerson will install its Ovation control system at Ambarli A. The technology will directly control and provide overspeed protection for the plant's six Siemens V94.2 gas turbines. The system will also control three Siemens dual-pressure condensing steam turbines, heat recovery steam generators and balance-of-plant equipment and processes.

Masdar inks wind farm deal

Abu Dhabi-based Masdar has signed an engineering, procurement and construction (EPC) contract with a global consortium for the construction of the first large-scale wind farm in Oman and the GCC.

The Dhofar wind power project will be built by GE and TSK, with funding from the Abu Dhabi Fund for Development (ADFD). With a capacity of 50 MW, it will comprise 13 GE 3.8 MW wind turbine units.

Change in gas imports by region in the New Policies Scenario



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Natural gas trade by region in the New Policies Scenario

Net importing regions in 2040	Net imports (bcm)			As a share of demand		
	2014	2025	2040	2014	2025	2040
European Union	-265	-374	-379	63%	79%	82%
China	-58	-176	-268	31%	45%	44%
Japan and Korea	-174	-144	-147	98%	98%	99%
India	-18	-54	-100	35%	57%	53%
Other Asia	-4	-29	-88	5%	28%	54%
Southeast Asia	56	24	-27	25%	11%	10%
Other Europe	8	0	-25	6%	0%	16%

Net exporting regions in 2040	Net exports (bcm)			As a share of production		
	2014	2025	2040	2014	2025	2040
Russia	178	235	307	28%	35%	40%
Caspian	79	108	168	40%	43%	49%
Middle East	117	134	145	21%	19%	15%
Australia	25	100	136	36%	64%	68%
North America	1	58	127	0%	5%	10%
Sub-Saharan Africa	29	47	79	49%	51%	38%
North Africa	53	64	54	35%	34%	23%
South America	8	7	18	5%	4%	6%

Notes: Positive numbers denote net exports and negative numbers denote net imports. Import and export totals should sum to zero; the difference in 2014 is due to stock changes.

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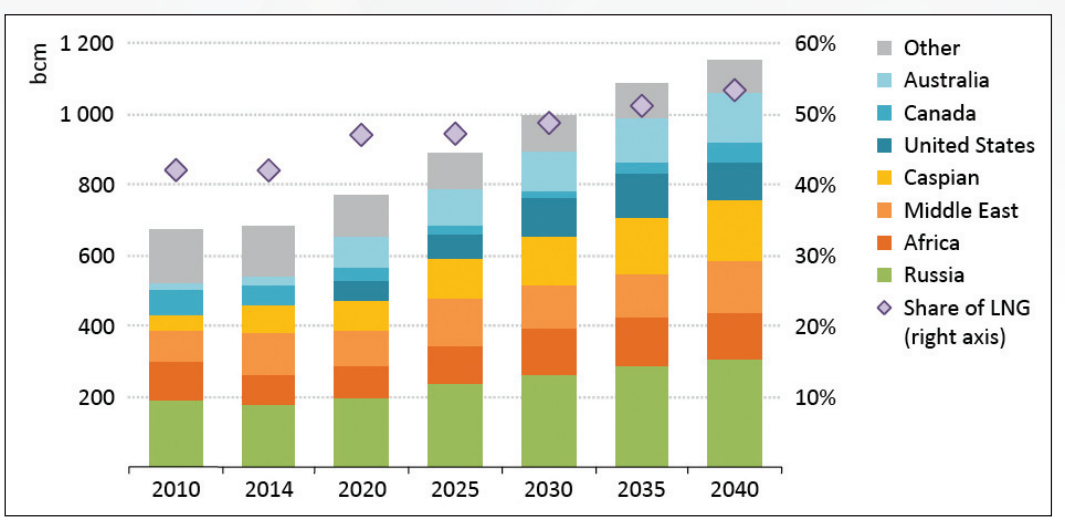
Global gas trade by exporter in the New Policies Scenario



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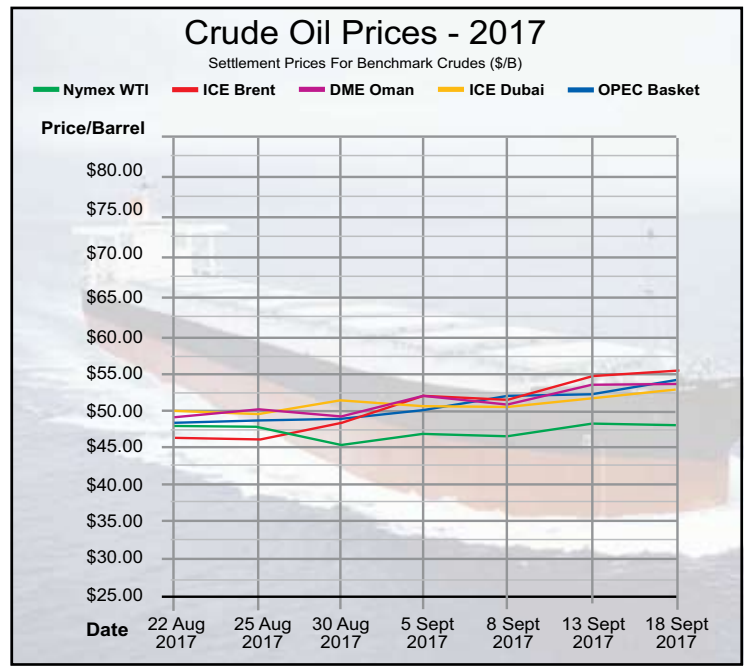
Source: World Energy Outlook 2016

Oil

US energy forecast shows fossil fuels remain key energy source

- Share of liquids for world energy consumption will fall
- Gas use will increase by 1.4 per cent annually



David Gregory

Fossil fuels will continue to account for 77 per cent of energy use in 2040, the US Energy Information Administration (EIA) states in its *International Energy Outlook 2017*, released on September 14. Although renewables will be the world's fastest growing energy source, with consumption growing at an average rate of 2.3 per cent annually between 2015-2040, fossil fuels will retain their position as the key source of energy on the planet.

The report uses a reference case that assumes continual improvement in known technologies based on current trends and relies on the views of leading economic forecasters and demographers for 16 regions around the world to make its forecasts.

The latest report has determined that total world energy consumption rises from 575 quadrillion British thermal units (Btu) in 2015 to 736 quadrillion Btu in 2040, an increase of 28 per cent, most of which will occur outside the OECD countries. Strong, long-term economic growth will drive the increasing demand for energy, the report states. The non-OECD countries, particularly China and India, account for more than half of the world's total increase in energy consumption over the 2015-2040 period, at the end of which, non-OECD Asia energy use will exceed that of the OECD by 41 quadrillion Btu.

During the next 25 years, non-OECD Asia is going to experience considerable growth, with GDP rising by 3.8 per cent annually, compared with world GDP growth of 3 per cent. Asia's GDP will drive a fast-paced growth in energy consumption in the region, the report said. By comparison, OECD GDP will increase by 1.7 per cent during the period, basically because of slow or declining population growth.

Liquid fuels will continue as the world's largest source for world energy consumption, but the share of liquids for world energy consumption will fall during the 2015-2040 period from 33 per cent to 31 per cent in 2040. The report said that oil prices steadily rise, many leading energy users will adopt more energy efficient technologies and switch away from liquid fuels when feasible.

Of fossil fuels, natural gas usage will grow fastest. Globally, its use will increase by 1.4 per cent annually. "Abundant natural gas resources and rising production – including supplies of tight gas, shale gas, and coalbed methane – contribute to the strong competitive position of natural gas," the EIA said.

For its part, coal, which saw strong growth in the 2000s, will not see that trend continue, but will remain flat over the next 25 years. Coal's share of overall world energy consumption declines significantly over the next 25 years, from 27 per cent to 22 per cent in 2040, as it will be increasingly replaced by natural gas, renewables and nuclear power (in the case of China) for electric power generation, and demand for it in industrial processes will also weaken, the report said. In China, the largest user of coal, usage declines by 0.6 per cent annually. Usage in the OECD also declines at the same rate. But coal consumption in India and other non-OECD will increase, and this means coal consumption "is not as low as it would otherwise be in 2040," the report said.

Despite the growing knowledge that hydrocarbon emissions are contributing to global warming and climate change, oil usage will continue to grow over the next 25 years, according to the EIA forecast.

The EIA projects that the use of petroleum and other liquid fuels will rise from 95 million b/d in 2015 to 104 million b/d in 2030 and 113 million b/d in 2040. Most of this growth will be in the transportation and industrial sectors.

To meet demand, world oil and other liquids production will increase by 16.1 million b/d between now and 2040. Opec will invest in incremental production capacity to maintain a 39-44 per cent share of the total world oil market through 2040, consistent with its share over the last 15, the report said. Increasing crude oil and condensate production from Opec will contribute 10.3 million b/d to the total world increase in liquids production.

Output from non-Opec countries will add another 1.6 million b/d, whereas production from other liquid fuels such as natural gas liquids and biofuels will add 4.2 million b/d and account for 97 per cent of the increase in other liquid fuels. Gas-to-liquids, coal-to-liquids, kerogen (shale oil) and refinery gain account for the remainder.

Gas

Turkey lines up Qatargas cargoes

Turkey is preparing to receive LNG cargoes from Qatar in a move to increase imports as demand for gas and electricity surges.

Mark Goetz

Turkey's pipeline operator Botas last month (September) signed a three-year agreement with Qatargas covering the delivery of 1.5 million tons per year (mn t/y) of LNG. Cargoes will begin to arrive this month as Turkey moves into winter, a time of year when demand for gas and electricity surges.

It is uncertain where the cargoes will be discharged. Turkey has three LNG terminals: the Egegaz LNG terminal at Aliaga, the Marmara Ereglisi LNG terminal, and the new floating storage and regasification unit (FSRU), called Etki LNG, which was installed and commissioned earlier this year on the Aegean coast near Aliaga.

Turkey already imports LNG from Nigeria and Algeria – a combined total of around 4 mn t/y – but it is likely that it will in future come to rely more on LNG as it takes steps to diversify its sources of gas supply and prepare to cover the leap in demand during cold winter months. During the inauguration of the Etki FSRU, Turkish Energy Minister Berat Albayrak said the government was considering the installation of another FSRU in two years' time.

The Etki LNG FSRU vessel, the Neptune owned by Hoegh LNG partners, has a capacity to process and discharge 20 million m^3/day, or around 5 mn t/y. The onshore terminals at Aliaga and Marmara Ereglisi, together have a capacity to receive some 12 mn t/y, giving Turkey the capacity to import up to 17 mn t/y.

The deal between Turkey and Qatar comes at a time when there exists a deep political rift between the Muslim countries of the Middle East. In June, Saudi Arabia, the UAE, Egypt and Bahrain severed diplomatic relations with Qatar, accusing it of supporting terrorist organisations in the Middle East. There has been an attempt to block Qatar's commercial activity, particularly its LNG exports, which are the largest in the world, but so far there has been no success towards that goal. Turkey has allied itself with Qatar's position on several issues through its own policies that support Islamic organisations in the region.

This will be the first year of operation for the Etki LNG terminal. During 2015 Turkey imported 7.4 bcm of LNG and 7.6 bcm in 2016, which accounts for around 16 per cent of Turkey's natural gas imports. In 2016, Marmara Ereglisi and Egegaz imported 5.484 bcm and 2.123 bcm of LNG respectively.

Turkey imports 99 per cent of its gas demand, but consumption has declined over the last two years. Demand was at 46.2 bcm in 2016, down from 48.4 bcm in 2015 and from 49.2 bcm in 2014. Like many Eastern European countries, Turkey relies heavily on Russia for gas supply. In 2016 Turkey imported 24.3 bcm of gas from Russia, of that 11.5 bcm arrived via the overland pipeline through Ukraine and Eastern Europe while 12.8 bcm was transported through the subsea Blue Stream pipeline across the Black Sea.

Besides Russia, Turkey relies on Iran and Azerbaijan for gas supplies. Iran gas supplies to Turkey amounted to 7.7 bcm in 2016, down from 7.9 bcm from a year earlier. Some years a heavy winter will force Iran to curtail its gas exports to Turkey, resulting in a shortage. Azerbaijan supplied Turkey with 6.4 bcm of Shah Deniz gas in 2016 through the South Caucasus Pipeline.

Imports from Azerbaijan will increase by a further 6.6 bcm in 2018 or 2019 when the Trans Anatolia Natural Gas Pipeline (TANAP) pipeline is completed. TANAP will be a component of the Southern Gas Corridor that will transport Azeri gas to Europe.

There are also plans for Turkey to import gas from Iraqi Kurdistan, which is autonomous from Iraq and run by the Kurdistan Regional Government (KRG). But the future of this idea is now in doubt as the KRG plans in late September to hold a referendum on independence of the region. Baghdad has cautioned against a move for the Kurds to attempt to separate from Iraq, and Turkey has threatened retaliation if the Iraqi Kurds vote to establish an independent state, fearing the move will encourage the Kurds in Turkey and Syria to join the plan to establish an independent state of Kurdistan.

Turkish media have reported that plans are afoot to install two more FSRUs in Turkey in the near future; one with a capacity of 6 bcm/year by Maks Enerji for placement at the Gulf of Izmit, and the second at either the Gulf of Saros, near Galipoli, or at Iskenderun in the East Mediterranean.

Whatever happened to the nuclear renaissance?

Despite numerous setbacks and challenges, some argue the nuclear renaissance is far from dead.

Elina Teplinsky and **Vince Zabielski**

Early in the 21st century, the term "nuclear renaissance" entered our lexicon. The future of nuclear power looked brighter than ever in the West, as fossil fuel prices rose and concern over global warming grew in the public's consciousness.

Riding the wave of new-found enthusiasm for nuclear power, plans were made to deploy new units in Europe and in the United States using a new generation of nuclear reactor designs like Areva's EPR design and Westinghouse's AP1000. In Europe, construction of the first EPR began in 2005 at Olkiluoto in Finland, followed in 2007 by another EPR unit at Flamanville in France. In the United States, two AP1000 units commenced limited construction at Plant Vogtle (Georgia) in 2009 and two more AP1000 units entered the construction stage in 2013 at the V.C. Summer plant (South Carolina). In the UK, starting in 2008, potential new build projects were identified at sites in Somerset, Wylfa, Moorside, Oldbury, and Bradwell.

Fast forward to 2017, and none of the plants mentioned above has generated a single kilowatt of power. Olkiluoto 3 should have entered service in 2009, but it is now projected to be on line sometime towards the end of 2018, a staggering 13 years after construction started and bearing an eye-watering price of €8.5 billion -- a cost overrun of €5.3 billion.

Likewise, Flamanville 3 is now expected to start operations by the end of 2018, six years late and at least €7 billion over budget, assuming technical issues with metallurgy are sorted out.

In the United States, the owners of the V. C. Summer plant have abandoned the project after sinking about $9 billion into it, and the Vogtle units are struggling with cost and schedule overruns. In the UK, the project in Somerset – Hinkley Point C – is the farthest along, with some initial ground works under way, and a planned operating date between 2025 and 2027.

Despite the fact that the majority (255 of 449 worldwide) operating nuclear power plants are located in North America and the European Union, in some Western countries, such as Germany and Austria, anti-nuclear activism has kept public support for nuclear low for some time, with anti-nuclear sentiments exacerbated by the Fukushima Daiichi incident in Japan. Switzerland has announced that it is phasing out its nuclear programme, and even long-time nuclear supporter France has recently announced that it will be reducing its reliance on nuclear energy.

Making things even more difficult for those countries with plans to pursue new nuclear, Austria has vowed to fight any new nuclear projects anywhere in the European Union, and has challenged the state aid granted to the Hinkley Point C project in the UK. Although nuclear is the only source of low emission baseload power, governments in the West have limited their financial support to renewables, putting nuclear on an uneven playing field.

So is it safe to say the nuclear renaissance is dead? Not by a long shot. The nuclear renaissance is alive and well, but its epicentre has shifted eastward. In countries like India, China, and the United Arab Emirates, nuclear power has been embraced as the clean energy of the future. Russia is steadily constructing reactors domestically, while also establishing itself as a leading supplier of nuclear technologies and services.

For rapidly growing economies, nuclear provides reliable baseload energy to power quickly growing industries. China since the early 1990s has invested into importing nuclear technologies, as well as developing its indigenous nuclear industry. The country now wants to reap the benefits of this investment and has stated its intention to become a leading nuclear reactor exporter, offering Chinese designs with innovative and advanced design features as well as manufacturing and construction support for Western designs like the EPR and the AP1000.

India, on the other hand, has relied, since 1974, on its domestic industry after it was banned from the global nuclear community post a nuclear weapon test. Since it was recently re-admitted to that community, India is seeking to benefit from an ability to import foreign technologies, equipment and technical support to grow its already impressive industry. South Korea has been developing its nuclear expertise for decades, and its designs are a development of technology originally imported from the United States via a technology sharing agreement with Combustion Engineering, a US company that later was acquired by Westinghouse.

So is the East moving ahead of the West in the nuclear power race? Many indicators would say yes. New nuclear construction is surging in the East. Of the more than 50 reactors under construction today, the vast majority are being deployed in the East, including 20 in China, seven in Russia, five in India and four in the UAE. Further, China plans to quintuple its nuclear capacity to 150 GWe by 2030, while India seeks to add 17 GW of nuclear by 2024. In addition, the UAE is well on its way to completing a four-unit project at Barakah; Turkey has just kicked off the construction of its first plant at Akkuyu; and countries in the MENA region, such as Egypt, Jordan and Saudi Arabia are in advanced planning stages for new nuclear.

Zabielski: new nuclear construction is surging in the East

Recent and ongoing nuclear new build projects have given countries like China, Russia, and Korea – which has added over 5 GW of nuclear capacity domestically in the past six years and is building the Barakah project in the UAE – valuable nuclear construction experience, much of which has been lost in the West due to more than three decades of no new nuclear development. In addition, China has pursued an aggressive localisation programme, boosting its reactor design, manufacturing, engineering and construction capabilities to make it increasingly independent from the West in pursuing nuclear growth domestically and developing nuclear export capabilities.

The fundamental difference between the East and the West when it comes to nuclear power is largely one of will. In China, high energy demand growth and record air pollution are such great concerns that the country is deploying all available clean energy sources to address these concerns. In India, where GDP grew an impressive 7.1 per cent in 2016 alone, additional baseload capacity is desperately needed to power the country's rapidly expanding industrial base and burgeoning population. In the UAE and Saudi Arabia, both countries rich in energy resources, the governments realised that every barrel of oil they burned to generate electricity was one less barrel available to export. These governments all made a very conscious and thoughtful decision to pursue nuclear power and its many benefits.

The West, on the other hand, has for the most part ignored the important climatic benefits of nuclear energy. In the US, subsidised solar and wind energy, combined with the abundance of cheap (but greenhouse gas emitting) natural gas have forced less economical single-unit nuclear plants to prematurely shut down. Germany, in a knee-jerk reaction to the Fukushima Daiichi incident, decided to phase out its nuclear programme with little consideration of the long-term climactic impacts.

So has the East beaten the West? Not yet – thanks to the UK. From a nuclear power development perspective, the one shining light in the West is the UK, where the government has taken climate change very seriously and has recognised the advantages of carbon-free baseload generation that can operate 24/7. The UK has extended the same contract-for-difference scheme used to ensure the viability of wind and solar projects to nuclear new build. This scheme recognises the environmental benefits of carbon-free power, and provides the developer with a guaranteed price for the electricity generated.

The UK government's Education & Skills Funding Agency has also recognised the need for skilled nuclear workers, and has developed nuclear apprenticeship programmes. In the 2015 Spending Review, the UK government committed to invest in a nuclear research and development programme as part of its wider energy innovation initiative, which by 2021 will reach over £400 million ($542 million) per year.

In November 2016, a £20 million programme was launched that supports innovation in the civil nuclear sector across several major areas, including advanced nuclear fuels, research on next-gen reactor technology, nuclear materials, and advanced manufacturing methods, including small modular reactors (SMRs). The Department for Business, Energy & Industrial Strategy has also created a competition to identify the best value SMR design for the UK. In a nutshell, the UK is poised to become a major powerhouse in the global nuclear renaissance – if it keeps its political resolve.

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Teplinsky: the nuclear renaissance is alive and well, but its epicentre has shifted

A glimpse of the future

As the energy sector shifts to a market that will see low carbon, sustainable energy sources generating electricity in an increasingly distributed set-up, there are several technologies that will have a huge impact in terms of both facilitating the transition and disrupting the industry, as we know it. **Junior Isles**

The energy sector of the not too distant future will look significantly different from today. According to DNV GL's recently published *Energy Transition Outlook*, renewable energy sources will continue to rise, making up nearly half of global energy supply by 2050. At the same time, energy efficiency will improve faster than global economic growth due to the rapid electrification of the world's energy system, leading to a plateau in energy demand from 2030.

The report speaks of a "profound change" that will have significant implications for both established and new energy companies. Launching the report, Remi Eriksen, Group President and CEO of DNV GL noted: "Ultimately, it will be a willingness to innovate and a capability to move at speed that will determine who is able to remain competitive in this dramatically altered energy landscape."

Innovation, however, is driven by technology and energy companies will need to get a handle on which technologies are likely have the greatest impact on the sector and their businesses.

Commenting on the big technology waves, EY notes that different technologies will create different opportunities and stresses that there are several key technologies that are beginning to straddle multiple industrial sectors.

Thierry Mortier, EY Global Power & Utilities Innovation Leader said: "While obviously there are things like solar and battery technologies that are clearly disrupting the industry, there are important innovations going on in transportation and telecommunications that are triggering convergence of the energy industry with other industries."

EY identifies six mega trends or emerging technology areas that are the key elements in facilitating the energy transition – Artificial Intelligence (AI); Robotics; Blockchain; 'New Dimensions' (e.g. 3D printing, augmented reality and virtual reality); Internet of Things (IoT); and enabling technologies, which EY calls 'Liquid Applications' (e.g. Cloud and Fog computing).

Roll-out of these transformational technologies will depend on the technology itself as well as geography but it is clear that deployment of prototypes or new applications in the energy sector is under way.

"We see pockets of activity across the globe, mostly centred around Europe, the US and also nowadays, the Middle East... All of the big utilities are actively working on some of these topics, with pretty big investment programmes," said Mortier

"If you ask me which of these will be the next big wave, I would bet on artificial intelligence. We are seeing a fair amount of utility interest, with AI often being quoted as the new digital."

He added: "Blockchain is probably the most disruptive of the technologies. It is a bit immature but it is disruptive since it eliminates the central authority in a lot of transactions and interactions between players in the market... now that blockchain is getting over the hype, a lot of utilities have their prototypes now in place."

Explaining the "hype" around blockchain, Mortier says: "When people 'discover' a new technology, initially they can imagine all sorts of applications and there is a lot of excitement that it will immediately be disruptive. But people have discovered that there are still a lot of barriers to successful wide-scale implementation – there are legal constraints. But because the initial excitement is over, that does not mean it will not be very impactful or very meaningful. It just means that there has been a reality-check and it will now go down the normal maturity curve."

EY believes that the full force of disruption to the energy industry will be unleashed when all of these technologies come together. "There are two important elements that we keep in sight when following these trends: first, is the pace of development and when they will mature; second, is the collision of these technologies because they do not stand on their own."

EY has examples of how technologies such as AI, blockchain and drones can be combined. At its Experience Lab in Paris, it has designed a prototype solution to maintain and inspect solar panels. When the efficiency of the panels decreases, based on measurements of the productivity of the solar panels, a message is sent out on the blockchain to indicate that there might be a problem. This is picked up by an inspection engine, which sends a drone to take a picture of the solar panel. AI then uses image recognition to assess the state of the panel. If it needs to be cleaned, an inspection order is sent out on the blockchain, which is picked up by the service company doing the maintenance. After maintenance, the drone is sent out again to take another picture. If the image is fine, the payment to the service company is made automatically through the blockchain.

"This demonstrates that very complex processes can be managed through the use of these components, but they must be considered together," noted Mortier.

He cited another example, which also illustrates why he believes AI will be the next big thing. According to Mortier, AI's potential to increase energy efficiency and its ability to support the development of new services is now being realised. For example, Singapore-based start-up BeeBryte provides a service that uses AI, delivered through the Cloud, to help buildings use less electricity and become smarter.

Assuming the building has a solar panel and a battery, AI and machine learning techniques use electricity market information, weather forecasts, fuel consumption patterns, etc., to make the arbitrage as to whether the building owner should produce, sell, or store electricity.

"This is a key example, because it encapsulates a couple of key elements," Mortier observed. "It's an outside company – basically a start-up – using all the new technologies that are available to provide a new service at a reasonable cost. It's a dedicated service that is fully automated through a digital gateway, which is the smart meter."

In yet another example, Google and National Grid of the UK are working together where deep learning techniques are being used to identify electricity consumption patterns at Google's data centres in order to reduce electricity costs.

Case studies such as these show there is great potential for technologies such as AI throughout electricity market value chain – from generation, through to transmission, distribution, electricity trading, etc.

Looking at the other key mega trends, 3D printing is increasingly being applied in manufacturing. In terms of new products, it makes it possible to quickly produce prototypes of new component designs for testing, such as is now being seen in the gas turbine business. There is also now the possibility to print spare parts as they are needed, eliminating the need to hold those parts in stock or have them delivered from factories – useful at offshore drilling platforms.

There is also interesting research work under way at the Massachusetts Institute of Technology (MIT) in the US, where 3D printing is being used to produce solar panels, with impressive initial results. "At this stage there have been amazing results, with a factor of 10 increase in efficiency due to the shapes that can be produced," said Mortier.

Augmented reality (AR) and virtual reality (VR) are also becoming more prevalent. VR is proving its value in training, while AR could be useful, for example, where an engineer or road worker needs to know where cabling is located. "There are endless applications and we have seen a lot of interest from utilities in this area," Mortier commented.

Mortier: the full force of disruption will be unleashed when technologies come together

At the same time, enabling technologies or 'liquid applications' allow solutions to be developed at a faster pace than ever before.

"If you wanted to develop a product or technology solution, in the past it would have taken six months or maybe a year, with significant cost and extensive testing," explained Mortier. "The new way of composing applications, based on variable applications already on the market, allows development cycles of 10-12 weeks for apps."

Mortier believes Fog computing will be increasingly important. "Unlike Cloud computing – where the computing capacity is in a centralised place but is available everywhere – in Fog computing, the computing capacity is distributed in nodes or devices throughout the network.

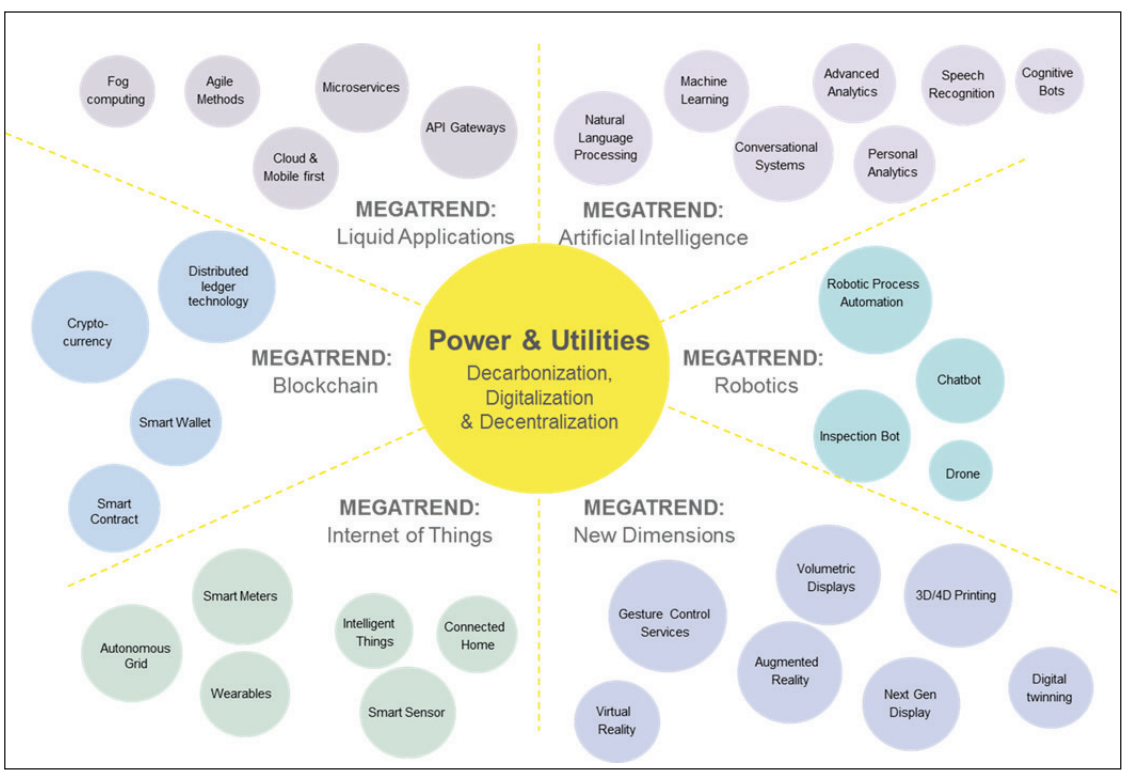
"It's at an early stage but is very relevant for the electricity industry because, like distribution, it is distributed by nature. Where there are millions of meters, data aggregation is a big challenge – how do you bring all this data back to an entity to make a decision on it? Technologies such as Fog computing and blockchain are also distributed by nature and therefore match well with the physical electron world."

Indeed Mortier sees the future of the electricity sector as being distributed and much more "peer-to-peer enabled", where individuals will be much more in control of their own electricity generation, consumption and storage.

He concluded: "You will see the role of the central authority, i.e. the utility, being increasingly questioned. Blockchain technology will enable that and AI will automate some of the decision-making. Good examples, such as Brooklyn Microgrid, already exist."

Projecting forward, if such solutions become widespread as the enabling technologies become ubiquitous, it is entirely possible that the utility as we know it may disappear. But this does not mean the future is bleak for utilities; it will just be different.

There is no reason why utilities may not use these same technologies to move into other areas such as electromobility, providing services they might never have imagined.



EY has identified six mega trends or emerging technology areas

Twin powers

Seawind is set to install a full-scale demonstrator at the MetCentre demonstration facility in Karmøy, Norway

A full-scale demonstrator of a two-bladed wind turbine capable of withstanding hurricane conditions is due to be installed next year.
David Appleyard

Technology first developed by NASA is set to blast into the offshore wind sector with a low-cost twin-bladed machine rated at 6.2 MW. Due to begin construction next year, and with a scaled-up 10 MW design anticipated by 2020, the machine is expected to deliver energy at around half the cost of current three-bladed offshore wind turbines.

The brainchild of renowned helicopter engineer Glidden Doman, the teetering hinge at the heart of this technology allows the rotor two axes of motion and confers a number of advantages. Primarily, as teetering motion can absorb the impact of wind shear and other differential forces on the rotor reducing the fatigue loads. In addition, as twin bladed machines have to rotate faster to generate the same power as a three-bladed machine, they produce much less torque. This allows drivetrain components and associated bearings and mountings to be smaller, making such machines far lighter and therefore less expensive.

Emerging from the oil crisis of the 1970s, when the Carter administration set up a NASA-led research programme to explore wind technology with Boeing and Hamilton Standard, the latest incarnation of the teetering technology is found in the Seawind 6. An upwind two-bladed, variable speed turbine, the 6.2 MW unit comes from Amsterdam-based Seawind Ocean Technology, founded by Martin Jakubowski and Silvestro Caruso in 2014, with the engineering office in Genoa, Italy.

Although, teetering machines were developed and installed as far back as 1975 – the 2.5 MW MOD-2 machine in Goodnoe Hills, Washington for example – at large scale they have failed to make much market impact. Seawind CEO Jakubowski explained: "It's all well-known technology, it's nothing new, but the disadvantages of two-bladed wind turbines are two-fold.

"One is that when they rotate they do not look pleasant. If you look at a two-bladed wind turbine it doesn't seem to the eye to be rotating in a gentle and evenly distributed way. It's an optical effect, but it appears to get certain accelerations and then it slows down, which doesn't look nice. The aesthetics are a significant impediment in populated areas so three-bladed machines are the better solution there.

"Secondly, two-bladed machines must rotate faster to produce the same energy as a three-bladed equivalent. Rotating faster, inevitably the blade tip cutting through the air creates higher tip noise. Higher noise emissions are a problem in getting popular acceptance for wind turbines on land."

However, in the offshore arena where this noise and poor aesthetics are no longer an issue, these disadvantages vanish. As Jakubowski says: "Going offshore you can go back to the fundamental reflection which NASA did in the 1970s - 'What is the most economical way of producing the energy?' That's the two-bladed."

Power production from the turbine is controlled by yawing into and out of the wind, there is no pitch control or associated hardware. Furthermore, introducing the teetering hinge between the rotor and the drivetrain effects a disconnect in the gyroscopic system of the wind turbine. Jakubowski said: "We overcome the gyroscopic effect more easily because the axle of the rotor and the axle of the drivetrain are not rigidly connected. There is a flexible joint between them. We can yaw easily into and out of the wind, just as a helicopter can change directions easily instantly, it's very versatile."

Seawind's simulations show an 85 per cent reduction in the forces required to yaw the machine when compared with three-bladed machines. As a result, although there are four yaw motors fitted to the 6.2 MW machine for reasons of redundancy, only two are required. This compares favourably with three-bladed machines.

"The residual gyroscopic effect is due to the stiffness of elastomeric elements which constitute the teetering hinge. If there were no stiffness in the hinge the blade would touch the tower," adds Jakubowski.

For the nacelle a stiff tubular steel body is used as a structural member to support the gearbox and generator, rather than a framework floor structure. This makes the turbine very robust although lightweight.

Another characteristic of the twin-bladed machine is its ability to withstand even in hurricane conditions by putting the blade tip into the hurricane. Braking the rotor is achieved by yawing the rotor plane perpendicular to the wind direction and pointing the tip of the upwind blade directly into the wind. The simulations have also shown that the teetering hinge minimises structural loading on the turbine in extreme winds.

Jakubowski noted: "You just idle the rotor out, we use the brakes only to keep it in parking conditions for maintenance or similar. In very strong storms we would block it, but because we have this flexibility, like a palm tree is flexible, if it is 10 or 15 degrees not pointed directly into the wind, it is no issue. The loads on our rotor in such a situation are exactly the same as during normal operations. So we have no overloading of the turbine."

For this reason, the Seawind 6 is mooted as a potential market winner in regions such as Asia and the US which are affected by hurricanes and typhoons.

Seawind is also developing three types of concrete foundation for the machine: gravity base, with piles and floating. "Everything is in concrete so no steel at sea. Very reduced noise emissions and concrete can offer space to crustaceous, so it's a much more environmentally friendly than steel," says Jakubowski.

Using concrete for the foundations is also advantageous for installation. Using the Seawind-designed system, the fully assembled turbines are loaded aboard a semi-submersible vessel at the quay-side. This vessel then transports the complete systems, four at a time, to the site location. There the turbines are offloaded at sea where they float. Towed to the exact location required, the turbine foundation is ballasted with water and sunk to the seabed. In a subsequent operation sand is used to replace the water ballast in the foundation to increase the mass inside the water for stability during all operations.

As Jakubowski observes: "In water you can float things and you can sink them to the seabed rather than building expensive crane vessels and installation methods with lifting operations."

The importance of concrete structures to the Seawind vision has been realised through a strategic alliance with marine engineering company Olav Olsen, famous for the 472 m-high Troll A concrete platform. Announced in February, according to a statement the deal will see Olav Olsen-designed concrete fixed and floating gravity-based structures used for Seawind machines.

Commenting, Olav Weider, Managing Director at Olav Olsen said: "We have worked closely with the Seawind technical team to develop a specific design for their unique two-bladed wind turbine."

Another Seawind partner is an unnamed American university research group working on ultra-high strength concrete.

The 6.2 MW machine follows on from a 1.5 MW demonstrator, the Gamma 60, which was installed in Sardinia, Italy, backed by Alenia, Finmeccanica and Enel. Armed with a treasure-trove of data from those trials and with some of the original design team aboard, Seawind is now set to install a full-scale demonstrator of its own at the MetCentre demonstration facility in Karmøy, Norway. Olav Olsen will supply the gravity base support structure for this machine, designed for water depths of between 35 and 90 m. At Karmøy mean wind speed is 9.7 m/s and water depths are around 40 m.

Due for installation next year, Jakubowski says of the development: "We are finalising the detailed design, we have identified all the suppliers. We have made the applications now for funding from the Norwegian ENOVA innovation institute and the European Investment Bank. If everything goes well we will start ordering the components by the end of this year."

Looking further ahead he adds: "We need one year of operation of the demonstrator to get full certification. But we will already start industrial production, let's say the second half of the certification period. So that we think that we will be able to install the first offshore wind farm with our technology in 2020."

Key to the success of any wind turbine design is the lifetime levelised cost of energy. Seawind believes its twin-bladed formula can deliver. With a budget of around €25 million for the demonstrator installed at sea complete with site engineering and fees, Seawind argues this is about half that of comparable demonstrator machines, a figure the company also suggests for serial production capex on its turbines.

Commenting on the 6.2 MW demonstrator, Jakubowski says: "The electricity price in Norway is very low, with the green certificate you get only about €4.5 cents/kWh, but we can make it with those values with the full scale prototype of the 6.2 MW unit."

A bigger machine is already on the drawing board: "We are already starting to design a 10 MW unit and we plan to install the first in 2020. We will submit an application to the Dutch government to install it in their innovation tender Borselle V but we also have alternative positions, one would be a floating unit in Scotland."

For the future Jakubowski's vision is an offshore wind installation which has the characteristics of a large hydropower plant, running for many decades with low opex. "In offshore wind we have to come to the same situation, where we have them running for 70 or 100 years at marginal cost. So that you can go down with the price to where the large hydropower plants are today."

Attracted by the longevity, simplicity of manufacture and low-cost of concrete, Seawind is now looking at producing the entire support structure up to the nacelle out of this material.

Jakubowski concludes: "Our turbine has a design life of 25 years but with a life extension programme we will bring it to 35 maybe 40 years. If you have a generation of turbines featuring one concrete structure then you come to a situation which is very similar to a large hydropower plant."

Listen, learn, leverage

Junior Isles

For every reason a chief information officer might find to digitalise an organisation's operations, a good, old-fashioned chief executive could probably find an excuse not to, or at least why they should take a go slow approach.

One of the main fears that big organisations with a large number of assets have with regard to digitalisation is cyber security.

Speaking at last month's FT Digital Energy Summit in London, Leo Simonovich, Vice President, Global Cyber Strategy at Siemens, said: "When we talk to our customers, it is the number one barrier to the adoption of digitalisation. Digitalisation means connectivity and there is a real fear of connectivity. When we talk to them, they say the risks outweigh the rewards… Unlike in the IT [information technology] space, if you get hacked on the OT [operational technology] side the consequences can be catastrophic."

When considering the spate of high-profile ransomware attacks across various sectors this year and what could potentially be compromised at assets such as power plants and electricity networks, the reticence of utilities is understandable.

Yet, greater connectivity brings significant benefits. According to Simonovich, increased connectivity gives an organisation greater visibility into its assets and operations, and therefore greater ability to detect and respond to an attack. He added: "You can collect data for business performance – think about fleet management, asset management."

Digitalisation is now at the core of GE's strategy going forward. According to Chairman and CEO Jeff Immelt, it is "the biggest transformation in the history of the company". Last year the company said revenue generated from digitalisation, across all its divisions stood at just over $6 billion and was growing at 25 per cent a year. Immelt predicts the company's digital revenue will reach $15 billion by 2020.

So what technologies are likely to unleash this value? GE, like others, believe the Internet of Thing (IoT) will have a huge impact on realising the benefits of digitalisation. Many also believe artificial intelligence (AI) and deep learning techniques, as well as disruptive technologies like blockchain will be hugely influential.

Again stressing the security aspect, Simonovich told delegates: "Blockchain has an enormous use case in cyber security... AI and machine learning, and the monitoring associated with that, can come together with blockchain to find those little nuances, those little spikes that can tell you whether there are any odd events happening."

Paul Massara, CEO Northstar Solar, meanwhile, commented on the importance of AI to end users perhaps involved in both consuming and generating electricity. "Battery storage will be a massive play," he said. "What you will then need is artificial intelligence and machine learning – which will be a massive game-changer – consumers will want to adjust something at a certain time of day or get engaged. Whoever is managing this for them will have to do it on the basis of smart, intelligent, machine learning.

"Machine learning combined with all the assets you have in the house, which can be effectively used to balance the grid along with a battery, is going to be very important.

Such applications demonstrate that digitalisation is as much about creating new opportunities right across the value chain – for all players in the various parts of the chain – as it is about security, improving efficiencies to drive revenue, or cutting costs at large organisations or utilities.

Jonathan Kini, CEO of Drax Retail, talked about how to create digital experiences that transform the relationship between brand, consumer and employees. He noted the importance of management bringing along employees and consumers on the digital journey.

"Ultimately, some of the digital capabilities will drive down costs for you as a business... but the biggest risk of any digital transformation is to not engage people on the front line. We have to be careful that we don't start to switch people off, so they think the only reason we are transforming to digital is to drive down costs."

Extending this philosophy to consumers, he said: "What customers are looking for is entirely different to what's happening in the boardroom. My recommendation to anyone in retail, is to get out and listen to the customer journeys; determine what are the customer journeys today and what are the customer journeys that you want in the future and be really brutal with yourself – are they the ones you want or are they ones the customer wants? It's OK if some you want are in there, such as efficiency, etc., but make sure the balance is fair."

This all points to a cultural shift, which perhaps is the biggest challenge facing energy companies making the digital transformation. Large centralised organisations cannot operate in the same way in the digital world as they have in the past.

Yves Le Gélard is Chief Digital Officer and Group Chief Information Officer at French energy giant Engie. He commented: "The world where the clear-cut business case that we used to have in this industry – where there was a big committee, chaired by the CFO assessing the return, etc., – is no longer [here] anymore. Being able to do things on a three-month cycle, and figure out three months down the road how much more we need to do, is counter-cultural. This act of faith that makes digital ultimately something that everyone has to commit to, has to come from the top. If the CEO is not breathing the target, then some challenges might appear.

> "It is about looking to other sectors and taking best practices and technologies as well as partnering with innovative start-ups"

The cultural nature of the challenge was best highlighted in a graduate panel session where 'millennials' offered their views. Moderating the session, Roland Hess, Senior Vice President, Applied Excellence at innogy SE, pointed out that the main difference between them and him is that he "grew *into* a digital world, while they grew up *with* a digital world". This, he said, means they possibly see things very differently.

"They don't necessarily work for a pay-cheque, they seek purpose. They don't want to have a boss, they want to have a mentor," he said.

Certainly it was clear that the millennials felt weighed down by bureaucracy – wanting to do cool things but weighed down by history. One panellist said: "People will say we do it this way because we've always done it like this."

In an environment where the new employee culture will be about failing fast and learning fast – as opposed to not making a mistake – CEO's will need tremendous courage and open-mindedness if they are to successfully embrace the digital world. It is about looking to other sectors and taking best practices and technologies as well as partnering with innovative start-ups.

Commenting on Drax's approach, Kini said: "We can't ignore other industries anymore because consumer and business expectations are being set by other industries. If we assume that we as an internal industry can take our time in making change happen, unfortunately we are going to be disrupted."

What organisations will need to do going forward was probably best summed up by Andrew McGreath, Director Enterprise Field Development at Equinix. He said: "I take three words from my CEO – listen, learn and leverage. Regardless of what industry you are in, go broader. Go outside your comfort zone and find out what your partners, suppliers or maybe your peers are doing."

It may be a strange concept to some power industry stalwarts but it is sinking in. On the sidelines of the conference, Peter Halliwell of plaus.com, and one of the millennial panellists asked me: "Do you think they really get it? Are they actually doing it?" I replied: "If you asked me that 18-24 months ago, I might have said no. But today, I believe they actually do."

Cartoon: jemsoar.com