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A 50 MW system is being developed that will allow electricity from wind and solar to be used to produce synthetic gas that could serve as a form of energy storage and also be used to decarbonise the industry and transport sectors. **Page 15**

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Wylfa suspension jeopardises UK nuclear plans

Hitachi's Higashihara says a "freeze" means the company will not put in any additional investment

The UK's plan to build a new fleet of nuclear power plants is under severe threat following the suspension of another of its proposed projects. **Junior Isles**

The UK's plan to build a new fleet of nuclear power plants is in danger of collapsing following Hitachi's decision to pull the plug on its 2.9 GW Wylfa project in Anglesey, Wales. The news comes just two months after Toshiba's decision to scrap its plan to build the 3.4 GW Moorside plant near Sellafield, Cumbria.

Hitachi formally suspended the £20 billion (\$26.4 billion) project at a board meeting in Tokyo in January in a move that will see it write off ¥300 billion (\$2.8 billion) in project related activities.

The company said it had decided to suspend the Horizon project from the viewpoint of its economic rationality

as a private enterprise, noting that "it is now clear that more time is needed to develop a financial structure".

Toshiaki Higashihara, Hitachi's President and CEO, said: "A freeze means we will not put in any additional investment." He added that the company would only renew its involvement if the project was kept off Hitachi's balance sheet, required only a limited capital investment from the company and offered the prospect of an adequate profit.

Duncan Hawthorne, CEO of Horizon Nuclear Power, the company set up by Hitachi to develop the project said: "I am very sorry to say that despite the best efforts of everyone

involved we've not been able to reach an agreement to the satisfaction of all concerned.

"As a result we will be suspending the development of the Wylfa Newydd project, as well as work related to Oldbury, until a solution can be found. In the meantime we will take steps to reduce our presence but keep the option to resume development in future."

The collapse of the power stations and the Moorside project that Toshiba scrapped in November means the government could have a huge hole to fill in the late 2020s and early 2030s. Together the three power stations would have supplied 15 per

cent of electricity demand.

The British government and financial institutions agreed to provide ¥2 trillion (\$18.3 billion) to support the project, which was the initial estimated cost. But with escalating forecast on the final cost Hitachi has failed to find investors to finance the balance. The government revealed it had also been willing to offer Contract for Difference terms with a strike price of up to £75/MWh.

Greg Clark, the Secretary of State for Business Energy and Industrial Strategy addressed the Commons concerning the UK's nuclear future following the announcement. He said:

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Tighter rules needed as energy supplier collapses continue

There have been calls for energy regulator Ofgem to introduce tighter regulation as the number of collapses of UK energy suppliers reached 10 in the last 12 months. At the end of January Our Power became the latest to fold, two just weeks after Economy Energy ceased trading.

Industry experts say four major issues must be addressed relating to new entrants: a lack of checks on entry, unfair cost exemptions, loss-leading tariffs, and the lack of consequences for failure.

Jane Lucy, Founder of Labrador, a company that enables automated supplier switching, said: "The fact

that eight energy providers ceased trading in 2018 and another two have closed only 25 days into 2019, indicates that Ofgem does not have the correct due diligence in place to ensure that energy providers are properly regulated... Energy suppliers should have to validate the financial health of their business, given that there are wider issues surrounding the obtaining of licences in general. It is only through proper regulation that the industry can prevent further closures."

Professor David Elmes, leader of the Warwick Business School Global Energy Research Network, said,

however, that asking the regulator Ofgem to look again on the checks it does on companies is not the only solution needed.

"The government needs to think again about the policies it makes that Ofgem has to implement," he said. "Last year we saw eight energy companies collapse and the merger between SSE and nPower fall apart. The collapse of Economy Energy shows 2019 is going to be no easier for the energy sector."

Members of the 'Big Six' suppliers also called for intervention. "We've got to a point where the industry, the regulator and the politicians need to

sit down and think about this," said Keith Anderson, CEO of Scottish Power. "I think they need to look at the mess that currently exists and how it can be dealt with and cleaned up."

Lucy warned, however, that the current turmoil, which has largely been the result of too many suppliers entering the market too quickly, should not be seen as a reason for consumers to favour the Big Six.

"It is also important to stress that the closure of the aforementioned energy suppliers does not mean that you need to submit to poor customer service and extortionate prices from the big six energy suppliers," she said.

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“Nuclear has an important role to play, as part of a diverse energy mix, but it must be at a price that is fair to electricity bill payers and to taxpayers. We will work closely with Hitachi and the industry, to ensure that we find the best means of financing these and other new nuclear projects.”

The government’s stance has been influenced by the falling cost of renewables, which have plummeted in recent years, causing a rethink on policy. Clark said clean sources of power, such as offshore wind, have fallen in cost “to the point they will soon need no public subsidy”.

In a letter published in the *Financial Times* he wrote: “In fact, the last contract for difference auction in the UK procured 3 GW of offshore wind – equal to the capacity of a nuclear power station – for only £57.50 per MWh.”

Some, however, see Wylfa’s suspension as a significant blow to the UK’s future energy supply plans. A statement issued by Matthew Fell, Chief UK Policy Director at Confederation of British Industry said: “The government has to demonstrate it is committed to meeting our climate change targets by supporting new low-carbon power supply.”

“The loss of new nuclear projects could leave us more heavily dependent in the long-run on fossil fuels, which could risk our legally binding climate targets. The government needs to build on its support for new nuclear power by giving individual projects the certainty they need, alongside measures that deliver a mix of low-carbon and renewable technologies.”

Rebecca Long-Bailey MP, the Shadow Business Secretary, said the government’s nuclear strategy was “lying in tatters”.

Doug Parr, Chief Scientist for Greenpeace UK agreed but welcomed news of the project’s suspension. “The government’s energy



Long-Bailey said the government’s nuclear strategy was “lying in tatters”

policy is in tatters, but this is the opposite of a disaster. We could have locked ourselves into reliance on an obsolete, unaffordable technology, but we’ve been given the chance to think again and make a better decision,” he said.

“Our urgent, immediate dilemma – how to maintain security of supply whilst cutting carbon – can be solved by making offshore wind, at half the cost of nuclear, the backbone of the new power system. The failure of the old technology is the opportunity the new technologies need.”

EDF Energy, however, remains convinced nuclear energy has a “strong future”. A spokesman said: “Nuclear provides low-carbon electricity when the wind doesn’t blow and the sun doesn’t shine. It will help lower overall energy costs to consumers as part of a balanced energy mix.”

EDF is currently building the new Hinkley C project – the only one of the UK’s planned 16 GW of new nuclear plant to begin construction so far. At the start of January it also began the latest round of public consultation for its proposed Sizewell C sister project.

USA continues clean energy shift but carbon emissions rise in 2018

- Carbon emissions increase by 3.4 per cent
- Electricity demand being met by gas

Junior Isles

The USA has seen carbon emissions rise after three years of decline despite coal plants being shut down.

Analysis, undertaken by the economic firm Rhodium Group, estimates that carbon emissions increased by 3.4 per cent in 2018. This rise is based on preliminary power generation, natural gas, and oil consumption data.

The transportation sector remains America’s largest emitter, while the power sector’s emissions increased 1.9 per cent. The buildings and industrial sectors also posted significant emissions totals in 2018.

In 2007, carbon emissions in the US peaked at 6 billion tonnes. Between

then and 2015, emissions fell by 12.6 per cent. Since 2016, the pace of US emissions decline has slowed, from 2.7 per cent in 2015 to 1.7 per cent in 2016 and 0.8 per cent in 2017.

The Rhodium Group estimates that if the US is to meet the Paris Agreement target of a 26-28 per cent reduction from 2005 levels by 2025, it will need to reduce energy-related CO₂ emissions by 2.6 per cent on average over the next seven years.

Although coal plants are being shut down they are being replaced by gas fired plant, which not only beat renewables in replacing most of this lost generation but also fed most of the growth in electricity demand.

FERC’s “Energy Infrastructure Update” report, (with data through

November 30, 2018) notes that new natural gas generating capacity put in service during the first 11 months of 2018 totalled 16 687 MW or 68.46 per cent of the total (24 376 MW). Renewable sources accounted for only 30.12 per cent led by wind (3772 MW) and solar (3449 MW).

Data published by the US Energy Information Administration (EIA) last month also showed that fossil fuels will continue to dominate the generation mix in the near term.

According to the EIA, natural gas fuelled 35 per cent of total US electricity generation in 2018, up from 24 per cent in 2010. In contrast, the share of total generation from coal fired power plants fell to 28 per cent last year from 45 per cent in 2010. EIA also

forecasts the share of gas fired generation will grow to 37 per cent by 2020 and coal will continue declining to 24 per cent by 2020.

However, new additions of renewable energy sources look poised to outstrip fossil fuel capacity additions. According to the EIA’s latest inventory of electric generators, 23.7 GW of new capacity additions and 8.3 GW of capacity retirements are expected for the US electric power sector in 2019.

The utility-scale capacity additions consist primarily of wind (46 per cent), natural gas (34 per cent), and solar photovoltaics (18 per cent), with the remaining 2 per cent consisting primarily of other renewables and battery storage capacity.

Global clean energy investments down in 2018

Global clean energy investment totalled \$332.1 billion in 2018, down 8 per cent on 2017 according to Bloomberg NEF’s (BNEF) latest figures.

There were sharp contrasts between clean energy sectors in terms of the change in dollar investment last year. Whereas wind investment rose 3 per cent to \$128.6 billion, solar dropped by 24 per cent to \$130.8 billion, partly due to sharply declining capital costs.

Despite a decrease of 32 per cent

from 2017, China was again a clear leader in 2018 with total clean energy investment of \$100.1 billion from a country perspective. The US followed at \$64.2 billion, up 12 per cent. Europe saw clean energy investment leap 27 per cent to \$74.5 billion, helped by the financing of five offshore wind projects in the billion-dollar-plus category.

Jon Moore, Chief Executive of BNEF, said: “Once again, the actions of China are playing a major role in

the dynamics of the energy transition, helping to drive down solar costs, grow the offshore wind and EV markets and lift venture capital and private equity investment.”

Offshore wind was a major recipient of clean energy investment last year, attracting \$25.7 billion, up 14 per cent on the previous year. Some of the projects financed were in Europe, led by the 950 MW Moray Firth East array in the North Sea, at an estimated \$3.3

billion, but there were also 13 Chinese offshore wind farms starting construction, for a total of some \$11.4 billion.

David Hostert, head of wind analysis at BNEF, said: “The balance of activity in offshore is tilting. Countries such as the UK and Germany pioneered this industry and will remain important, but China is taking over as the biggest market and new locations such as Taiwan and the US East Coast are seeing strong interest from developers.”

Offshore wind set to benefit from bigger turbines

The size of offshore wind farms are advancing to the next level as both Siemens and GE announced plans for their double-digit MW output wind turbines.

In January Siemens Gamesa Renewable Energy (SGRE), the world’s leader in the offshore industry, launched the SG 10.0-193 DD, the company’s first 10+ MW offshore wind turbine.

Commenting on its importance to the market, Andreas Nauen, CEO of the SGRE Offshore Business Unit, said: “The levelised cost of energy from offshore wind continues to decrease as industry scale and performance grow. New markets are developing across the globe, all of which require cost-efficient, reliable, and clean power for

generations. The SG 10.0-193 DD enables us as market leaders to meet these needs in close cooperation with our customers, stakeholders, and society-at-large.”

The 10 MW rating is made possible through a larger generator diameter, building on the proven SGRE Direct Drive generator technology.

By increasing the rotor diameter to 193 m, this new wind turbine offers up to 30 per cent more annual energy production than its predecessor, the SG 8.0-167 DD. Its 94 m-long blades provide a swept area of 29 300 m².

The technology on the offshore direct drive platform allows for the re-use of most components from previous generations, providing a short time to market. The prototype is ex-

pected to be installed in 2019 with commercial market deployment expected in 2022.

The annual energy production of one SG 10.0-193 DD is sufficient to supply about 10 000 European households with electricity. This means that an offshore wind park composed of 20 of these turbines would cover the annual electricity consumption of a city the size of Liverpool.

The news comes as GE Renewable Energy announced that it had signed an agreement with Future Wind, a joint venture of Pondera Development and Sif, to install the first Haliade-X 12MW wind turbine prototype in the Port of Rotterdam this summer.

The agreement, which will see the Haliade-X 12MW prototype installed


onshore to facilitate access for testing, includes five years of testing and a 15-year full-service operation and maintenance agreement.

GE said that the initial period of operations will allow it to collect data needed to obtain a Type Certificate, a key step in commercialising the turbine in 2021.

MHI Vestas is currently leading the race to deploy 10 MW+ turbines. In September it announced it had achieved a power rating of 10 MW with its V164 turbine platform.

The V164-10MW turbine is available for sale now, making it the first commercially available double-digit megawatt wind turbine.

MHI Vestas also said it can scale up its turbine to 12 MW.




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NY ramps up offshore ambitions

■ 9000 MW target proposed ■ 100 per cent renewables mandate set

Siân Crampsie

New York governor Andrew M. Cuomo has called for the state's offshore wind energy target to be quadrupled.

The state of New York has set a target of installing 2400 MW of offshore wind energy capacity by 2030, but in his 2019 State of the State speech last month, Cuomo called for the target to be set at 9000 MW.

He has also proposed additional measures designed to boost New York's green economy, including a mandate of 100 per cent clean, carbon-free electricity in the state by 2040.

That goal is the most aggressive of its kind anywhere in the country, Cuomo noted, and is set for five years earlier than the target recently adopted by California.

Earlier in January New York state authorities said that five developers had expressed an interest in taking part in the state's first offshore wind solicitation, in which 800 MW of capacity will be procured.

A number of companies have all registered their interest with New York State Energy Research and Development Authority (NYSERDA) for the auction. These are: Bay State Wind, a

joint venture between Ørsted and utility Eversource Energy; Vineyard Wind, a partnership between Copenhagen Infrastructure Partners (CIP) and Avangrid Renewables; Mayflower Wind Energy, a joint venture between Shell New Energies and EDP Renewables; Norway's Equinor; and Atlantic Shores Offshore Wind, recently formed by EDF Renewables North America and Shell New Energies.

NYSERDA said it will award 25-year power purchase agreements (PPA) to projects of between 200 MW and 800 MW, while it can contract higher capacity if "sufficiently

attractive proposals are received". Bids are due by February 14, while successful candidates will be announced in the spring.

Cuomo's latest plan for offshore wind includes investing \$200 million in the state's ports, establishing a State Advisory Council on Offshore Wind Economics and Workforce Development, setting up an offshore wind training centre, as well as initiating the first effort to evaluate and facilitate the development of an offshore transmission grid that can benefit ratepayers.

Cuomo also wants to increase New York's Clean Energy Standard man-

date from 50 per cent to 70 per cent of renewable electricity by 2030.

Ørsted has won approval from Connecticut regulators to negotiate an offtake deal for an additional 100 MW of capacity from the proposed Revolution offshore wind farm in federal waters off the coast of Rhode Island and Massachusetts. Connecticut has already approved a 200 MW power purchase agreement between developer Deepwater Wind and local utilities Eversource and United Illuminating; the remaining 400 MW of capacity will be sold to utilities in Rhode Island.

Enel sells Brazilian assets

Enel has sold three large-scale renewable energy plants in Brazil in order to help it fund new project developments in the country.

The Italian energy firm has agreed a \$782 million deal with CGN Energy International Holdings to sell two solar power plants and one wind farm. All of the projects are operational and are backed by long-term power purchase agreements (PPAs), Enel said.

The portfolio has a total capacity of 540 MW and was sold to China-based CGN through Enel Green Power Brasil Participaes. Enel Green Power head Antonio Cammisecra said: "With the sale of these assets we are capturing value for further growth in Brazil, where we are implementing a large pipeline of renewable projects.

"We remain focused on the opportunities offered by the Brazilian renewable market and we are continuing to invest in the country where Enel Green Power will play an active role by carrying out new projects and managing

the fleet of operating plants."

The portfolio comprises the 292 MW Nova Olinda solar plant, located in the North eastern Brazilian state of Piauí and the 158 MW Lapa solar facility, situated in the northeastern Brazilian state of Bahia, along with the 90 MW Cristalândia wind farm.

Lapa and Nova Olinda are supported by 20-year contracts, under which specified volumes of energy generated from the plants are sold to the Brazilian Chamber of Commercialisation of Electric Energy (CCEE). The Cristalândia wind farm is supported by 20-year PPAs with a pool of Brazilian electricity distribution companies.

Petrobras and Total have established a joint venture for the development of solar and wind power projects in Brazil. The new company is aiming to develop 500 MW of capacity in the next five years. It will be 49 per cent owned by Petrobras and 51 per cent by Total Eren.

Canada funds first geothermal plant

Canada's Saskatchewan province will host the country's first geothermal power facility.

The country's federal government has announced that it will provide C\$25.6 million (\$19.3 million) in funds for the proposed plant, which will be located near Estevan, south-eastern Saskatchewan.

The plant will be developed by Canada-based DEEP Earth Energy Production Corp. and will have an installed capacity of 5 MW. Prime Minister Justin Trudeau's office announced in January that financing for the project will be extended through Natural Resources Canada's Emerging Renewable Power Programme, which helped fund the pre-feasibility study for the scheme.

The plant will cost around C\$51 million to build and is expected to generate electricity for about 5000 homes. Excess heat will supply a local greenhouse.

DEEP announced earlier in January that it had successfully completed drilling of its first geothermal test well – at 3530 m, the largest ever drilled in Saskatchewan. The well will enable DEEP to acquire preliminary data to assess the geothermal reservoir.

"This is a major step forward for the first renewable energy project of its kind in Canada," said Kirsten Marcia, President and CEO of DEEP. "Successfully drilling and validating the resource potential is the biggest achievement this project has seen to date."

EIB supports solar in Mexico

The European Investment Bank (EIB) has agreed a \$87 million funding package aimed at supporting Mexico's renewable energy goals.

The bank has signed a loan agreement with Enel Green Power and its local partners in Mexico to help finance three photovoltaic (PV) solar power plants totaling 1088 MWp, located in Guanajuato and Coahuila States.

The projects are a key part of Mexico's energy policy and renewable energy objectives, EIB said.

The projects include the 754 MW Villanueva PV farm in Coahuila state, which was officially inaugurated by Enel Green Power in March 2018. Villanueva is the largest PV facility producing energy in the Americas and Enel's largest solar project worldwide.

The projects are operated and 20 per cent owned by Enel Green Power and 80 per cent by institutional investors Caisse de depot et placement du Quebec, and CKD Infraestructura Mexico. BBVA Bancomer, CaixaBank, Natixis, MUFG Bank, IDB Invest, the private sector institution of the Inter-American Development Bank (IDB) Group, and Mexican development institution Banca Nacional de Comercio Exterior (Bancomext) also supported the project.

The solar farms are part of a boom in renewable energy in Mexico since the country revamped its energy laws in 2017.

Last month Acciona said it has completed the assembly of the 405 MWp Puerto Libertad PV plant in Mexico, the largest the company has ever built.

Acciona said it took two months, from October 19 to December 19, for it to install the 1.07 million PV panels in the Sonora desert. It expects the project to start operating this quarter.

With the Puerto Libertad PV plant, Acciona Energia now holds a 1144 MW portfolio in Mexico, split between 739.5 MW wind and 404.5 MWp PV. It owns 50 per cent of the Puerto Libertad PV project under a joint venture with Tuto Energy.

Mexico is set to sign a deal with Hydro-Quebec to modernise the country's 60 hydropower plants. Mexico has an installed hydropower capacity of around 13 000 MW, but says that its resources are under-utilised. Refurbishment of the facilities will help to improve their availability and lengthen their lifespans.

Huawei panels pose cyber threat, warns Congress

Members of the US Congress have warned that the use of solar equipment manufactured by Chinese group Huawei pose a threat to the country's cybersecurity.

Both Democrats and Republicans have said that Huawei solar equipment could be hacked to allow a third party to slow or even interrupt US electricity supplies.

Inverters supplied by Huawei account for around 20 per cent of all inverters solar in the USA for small-scale commercial use, according to analysts.

The accusation comes amid heightened tensions between Washington DC and Beijing following the recent arrest of Meng Wanzhou, Huawei's Chief Financial Officer and daughter of founder Ren Zhengfei.

Jerry McNerney, a Democratic representative from California, said: "If we are using equipment that is made by less than trustworthy suppliers, we are setting ourselves up. US intelligence agencies have warned American businesses that Huawei is not to be trusted, so we need to take that seriously."

Bob Latta, a Republican member of the House committee on energy and commerce, said: "Ensuring our energy infrastructure is safe, secure, and resilient is an issue of critical importance. With documented efforts by state actors to hack our energy infrastructure, it's essential that we are more vigilant than ever about the technology we use."

Huawei vehemently denies that its solar products have vulnerabilities and stressed that its activities in the USA are in accordance with cybersecurity standards.

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China goes big on storage to accommodate burgeoning renewables

China is planning to build massive amounts of pumped hydro storage and battery capacity as its clean energy transition continues. **Syed Ali**

China's State Grid Corporation of China (SGCC) will build 6 GW of pumped hydro storage as part of ongoing efforts to cut rates of wind and solar power curtailment.

Wasted electricity from solar projects in the country's northwest has often been in double-figure percentages, with national rates of PV curtailment peaking at 11 per cent in 2015, according to official figures. These have been falling with the 2017 figure at just 6 per cent. The equivalent figure for wind power is 12 per cent.

The five pumped storage projects announced by the SGCC will be in operation by 2026 and require an investment of RMB38.7 billion (\$5.67 billion). China is targeting 40 GW of pumped hydro storage by 2020.

The country has also embarked on a national Mission for Energy Storage, which includes plans to build flow battery projects, some of which will be several hundred megawatts in size.

China is also pushing along its electric vehicle (EV) programme, which could also help renewables integration.

In a move that gives a significant boost to EVs, in late December SGCC and China Southern Power Grid entered a partnership with two private firms to create a RMB 500 million (\$74 million) joint venture (JV) specialising in providing charging facilities for EVs.

The new company, Xiongan Lianxing Network Technology Co. will be the country's largest electric vehicle charging operator and control about 80 per cent of the country's 730,000 charging piles. The company aims to develop more charging stations across the

country to cater for the fast growing number of EVs.

According to a recent report by BloombergNEF, in 2018 China was again the clear leader in clean energy investment "playing a major role in the dynamics of the energy transition, helping to drive down solar costs, grow the offshore wind and EV markets".

Offshore wind attracted \$25.7 billion of clean energy investment last year, a 14 per cent increase compared to 2017. This trend looks set to continue in 2019. In mid-January, the Jiangsu Province

in China approved 24 offshore wind projects with a total capacity of 6.7 GW. The announcement is part of the province's 10 GW offshore wind plan known as Three Gorges on Sea. The approved offshore wind farms are expected to be completed by the end of 2020.

China has approved construction of a dam on the upstream section of its longest river, the Yangtze. The dam is part of a hydropower project envisaged to eventually consist of four turbines with a total capacity of 2000 MW.

Bigger role for private sector in revised power plan

The private sector will play a bigger role in the addition of new generating capacity in Thailand's revised Power Development Plan (PDP).

The new version drawn up by the National Energy Policy Council (NEPC) for 2018-37, is expected to take effect from the second quarter. The plan can be revised every five years as changes and technological trends occur in the power sector.

The new PDP seeks to add 56,431 MW of new power capacity during the

plan period, 20,766 MW of which will come from renewable power projects. Power plants with a total capacity of 25,310 MW will be retired during the period, so total power capacity by 2037 will stand at 77,211 MW, up from 46,090 MW in 2017.

In 2037, 53 per cent of the country's power production will be generated by natural gas, 35 per cent from non-fossil fuels and 12 per cent from coal.

"We are very keen on renewable energy projects and energy conservation

plans, while power imported from neighbouring countries is generated from hydropower," said Energy Minister Siri Jirapongphan.

Notably, in the new PDP power production from state utility Electricity Generating Authority of Thailand (Egat) will be lower. Egat will now take more responsibility for system security from the grid connection. Energy Minister Siri Jirapongphan said: "It will not only receive fees from transmission lines but play a role in joining

in with investments. Egat is expected to finish its planning late this year."

After the new PDP is enacted, four other plans will soon be drawn up and implemented: oil management, natural gas supply, alternative energy development, and energy savings and efficiency.

Just prior to unveiling the new PDP the Energy Ministry announced plans to open bidding for independent power producers (IPPs) for a combined capacity of 8,300 MW this year.

Permanent Energy Secretary Kulit

Sombatsiri said new IPPs would be developed at large sites that will be fuelled by gas, coal and diesel. "All details for interested companies will be disclosed sometime this year," he said.

The Energy Ministry will allow solar panel owners to sell surplus electricity in communities from 2021, in line with the new national energy reform plan. Under the law, solar panel owners cannot sell power directly to others, but can sell it to the state grid under power purchase agreements.

Australia reviews rooftop solar compliance

The operator of Australia's electricity grid has raised the prospect of household rooftop solar panels being retrofitted to ensure they meet compliance standards after some units failed to adequately respond to a major interconnector outage last year, which isolated two states from the power system.

A range of supply sources including solar, wind and coal generators either tripped or were unable to assist in boosting supply to Queensland and South Australia when a lightning strike caused the Queensland and South Australia interconnectors to trip simultaneously last summer.

An official investigation subsequently found thousands of rooftop solar units did not comply with Australian standards.

The Australian Energy Market Operator detailed how 15 per cent of sampled solar systems installed before October 2016 dropped out during the emergency event. Of those installed

after that date, nearly a third in South Australia and 15 per cent in Queensland failed to meet the Australian standard for reducing excess frequency.

Changes to compliance and accreditation processes may be needed, according to AEMO, as it investigates why the solar inverters, which convert electricity from rooftop panels into power that can be fed to the grid, failed to respond as expected.

The market operator aims to complete an assessment of the technical requirements of solar inverters by June and improve their performance standards by the end of 2019. It also hopes to obtain better data and develop simulation models and analysis by the end of 2020 to predict the response of solar rooftop to "system disturbances" like last year's major outage.

The reliability of rooftop solar is becoming increasingly important as Australia moves away from fossil fired generation. At the beginning of

January, some states reported a sharp drop in brown coal generation as solar and wind output surged.

According to data compiled by Dylan McConnell, a researcher at the University of Melbourne's College of Climate and Energy, brown coal generation in Victoria was 8,227 GWh in the December quarter, down from 8,500 GWh in the December 2017 quarter and well below the 11,000 GWh in the December 2016 quarter, the last full quarter before Hazelwood's closure in late March 2017.

Gas generation also plummeted to just 3,183 GWh in the December quarter from 5,692 GWh in the December 2017 quarter.

The big winners were rooftop solar, which surged by more than a quarter to 2,690 GWh from a year earlier, utility-scale solar, which increased fivefold to 917 GWh as more large solar farms came online, and wind, up a fifth to 3,426 GWh. Hydro generation also grew 17 per cent to 3,400 GWh.

India's nuclear programme makes progress

The Department of Atomic Energy (DAE) has informed Parliament that 21 new nuclear power reactors with a total installed capacity of 15,700 MW are expected to be set up in the country by 2031. It also said that five designated sites, which would have a total of 28 nuclear reactors, have been given 'in principle' approval by the central government.

In a written statement Jitendra Singh, Minister of State for Personnel, Public Grievances and Pensions and Prime Minister's office (PMO), said that "at present, there are nine nuclear power reactors at various stages of construction" that are targeted for completion by 2024-25.

"In addition, 12 more nuclear power reactors have been accorded administrative approval and financial sanction by the government in June 2017,"

he added.

The update followed news that Indian and French experts will soon begin discussions to determine the cost of the proposed nuclear power plant in Jaitapur in the western state of Maharashtra.

The discussions to build the 9,900 MW Jaitapur Nuclear Power Plant (JNPP) have now been made possible by a techno-commercial proposal that French nuclear power company EDF recently submitted to India. A techno-commercial offer is significant in that it sets off the negotiations process as it helps the parties determine the project cost and the energy tariff.

The proposal is now before the Nuclear Power Corporation of India (NPCIL), the Department of Atomic Energy's arm that operates public sector atomic power plants.

Europe News



Germany has finalised plans for phasing out coal fired generation just as renewables start to overtake the fuel in electricity generation share.

Siân Crampsie

Representatives from Germany's government, industry and non-governmental organisations (NGOs) have reached a long awaited agreement on when the country will put an end to its reliance on lignite and hard coal fired power generation.

Germany's coal exit commission – convened by Chancellor Angela Merkel in 2018 to thrash out a definitive agreement on the coal phase-out – says that the country's coal fired power plants will close by 2038. A review will take place in 2032 to decide if the deadline can be brought forward to 2035.

The agreement is seen as a major step forward for Germany's energy transition. The country still relies on coal for around 40 per cent of its electricity generation, and the prospect of nuclear plant closure by 2022 means that other fuel sources – including natural gas and renewables – will have to grow considerably in the coming years to plug the gap.

Renewable energy has already made inroads into Germany's power generation sector, with wind, solar, biomass and hydropower accounting for more than 40 per cent of electricity generation in 2018, according to the Fraunhofer Institute.

Last year, solar power generating

capacity grew by 20 per cent, and combined with favourable weather conditions, the technology's contribution to power generation rose from 6.3 TWh in 2017 to 45.7 TWh in 2018. Generation from wind energy also rose in 2018, while hydropower generation decreased slightly due to the long, dry summer, Fraunhofer Institute said.

Offshore wind is also continuing to grow in Germany, with almost 1000 MW of new capacity added in 2018 and a further 966 MW under construction. According to Deutsche WindGuard, 1305 offshore wind turbines with a total output of 6382 MW fed into Germany's grid in 2018.

Deutsche WindGuard said in January that political conditions are slowing down the development of offshore wind energy in Germany. It believes that the country will not be able to meet its target of sourcing 65 per cent of power generation from renewable energy sources by 2030.

The coal exit commission's main task is to make sure that Germany's energy sector meets its 2030 climate targets, i.e., cutting greenhouse gas emissions by just over 60 per cent from a 1990 baseline. Its proposals include reducing Germany's 42.6 GW of coal power capacity to about 30 GW by 2022, and then to around 17 GW by 2030.

Its challenge has been, however, to balance these goals with the economic fallout of the coal phase-out – Germany's coal sector employs 20 000 people and there are particular regions that are heavily reliant on the coal industry.

RWE said in a statement that the commission's proposals "will have a serious impact on RWE's lignite business". It added: "The commission's recommended end date of 2038 for coal fired power generation is far too early. It is therefore reasonable to re-examine this date in 2032. An extension that is necessary from the point of view of security of supply should then also be considered."

UK clean air strategy targets particulates

- Strategy will support clean growth, says government
- Consultation planned on coal-to-biomass conversions



The UK government has launched an ambitious programme aimed at reducing air pollution in an attempt to improve the environment and improve public health.

The proposed Clean Air Strategy will tackle sources of pollution from all sectors of the economy, including transport and energy, and in particular aims to reduce people's exposure to particulate matter (PM).

In the Strategy's proposals, the government says it will seek ways to support clean growth and innovation, while policies surrounding electricity and heat will be geared towards improving air quality and tackling climate change.

The Strategy aligns with the government's current Clean Growth Strategy,

which aims to decarbonise the country's economy in line with climate targets.

The UK government also says it will consult on making coal-to-biomass conversion projects ineligible for renewable support mechanisms in the future.

In the UK several large coal fired power plants have converted to using biomass, including several units at the 4000 MW Drax power plant, which burns about 7 million tons a year of compressed wood pellets imported from the US and Canada.

There is concern that biomass firing produces similar amounts of carbon dioxide as burning coal, and also contributes to poorer air quality.

James Court, Director of Policy &

External Affairs at the Renewable Energy Association commented: "The government's Clean Air Strategy includes welcome ambitions to bring the UK's air quality in line with WHO limits. To take this plan forward, government must now deliver strong sector specific policies that support technologies to address these concerns, while also properly enforcing existing controls such as Clean Air Zones and existing legislation."

"From a renewable power perspective, proposals to remove future biomass power sites from future renewable power auctions seemingly ignore the strenuous, tightly controlled and audited emission standards already in place, which also continue to be strengthened."

Italy targets 93 GW of renewables

Italy is aiming to have an installed base of 93 GW of renewable energy capacity by 2030, according to its National Integrated Plan for Climate and Energy.

Italian Ministry of Economic Development (MISE) has submitted the plan to the European Commission, outlining its plans to boost renewable power generation as well as its main climate goals for 2020 and 2030.

According to the plan, Italy will have an installed base of 50 880 MW of solar – including 880 MW of concentrated solar power (CSP), 19 200 MW of hydropower capacity, 18 400 MW of wind and 3764 MW of bioenergy

by 2030. Renewable power generation will reach 187 TWh in 2030 – equivalent to 55 per cent of electricity consumption, MISE says.

In 2016, about 67 per cent of Italy's electricity production came from fossil fuels, while renewable energy, including hydroelectricity, was responsible for roughly 33 per cent of the country's electricity production. Italy has committed to phasing out coal fired generation by 2025.

Italy intends to reduce oil product consumption by 13 Mtoe by 2030 and to improve energy efficiency by 30 per cent.

Ostroleka C wins capacity market contract

Poland is pushing ahead with plans to develop the Ostroleka C coal fired power plant in spite of protests from environmental groups.

Elektrownia Ostroleka, a company co-owned by energy giants Enea and Energa, has won a 15-year capacity market contract for the project, which is set to become Poland's largest coal-fired power plant.

Enea and Energa has previously said that they would only go ahead with the project if it received the subsidies, which are likely to amount to around €1.4 billion over the 15-year contract.

In July, Elektrownia Ostroleka signed a contract with GE Power and Alstom Power to build the unit on the site of the 647 MW Ostroleka B plant in north-eastern Poland owned by Energa.

Environmental group Client Earth has launched a legal challenge to the project based on the risks to the climate posed by the project.

Client Earth is a shareholder in Enea and in 2018 filed a challenge against the company's decision to greenlight the 1 GW Ostroleka C plant.

The court action hinges on the "indefensible" financial risk the project

poses to investors due to rising carbon prices, increased competition from cheaper renewables and the impact of EU energy reforms on state subsidies for coal power under the capacity market.

ClientEarth lawyer Peter Barnett said: "This plant is a stranded asset in the making. The economic analysis is clear and there is widespread market concern about the plant."

"Companies and their directors are legally responsible for managing the financial risks and opportunities posed by climate change. Enea appears to be turning a blind eye to the well-documented risks threatening this project."

"Shareholders cannot sit back as companies gamble their funds on expensive, outdated and polluting technologies – climate litigation is only going to pick up the pace for companies that cling to fossil fuels."

Ostroleka C would have a net efficiency of at least 45 per cent. Energy ministry officials have said the unit is indispensable for power supply security and needed to synchronize the Polish power grid with those of the Baltic states.

Uzbekistan's nuclear power plans take shape

- Site choice and contract signing expected this year
- EBRD backs Uzbek CCGT

Construction of Uzbekistan's first nuclear power plant could start by 2022, according to local media reports.

The country is turning to nuclear energy as part of wider reforms aimed at boosting the economy, and is working with Russia to identify and develop the first site.

"Active work is under way in Uzbekistan to find a site for the country's first nuclear power plant, and measures have been launched to prepare the legislative framework necessary for the

construction of the station and cooperation between Uzbekistan and Russia in the field of nuclear energy," said Alexander Lokshin, Rosatom's first deputy director general for operational management, in an interview with an Uzbek news agency.

Russian firm Rosatom and Uzbek nuclear energy agency Uzatom expect to finalise the decision on the choice of site by the end of March 2019. They are also aiming to complete detailed surveys for the project this year, and to

sign a construction contract, *Kun.uz* reported.

The proposed reactor will consist of two units with a combined output of 2.4 GW. The first reactor could be on-line by 2029, while construction of the second unit could begin in 2024.

Uzatom head Jurabek Mirzamakhmudov was quoted by the *Financial Times* as saying: "We will be joining the club of countries with the peaceful use of nuclear energy. That is an elite club. This is a whole new

level, different type of relationships, new technologies, science and education development."

Uzbekistan is the world's seventh-largest uranium producer. "The choice was made in favour of nuclear power given uranium availability and most importantly, economic benefits to the country. Today this is one of the cleanest, ecologically safest sources of power, as well as the cheapest one after hydropower," Mirzamakhmudov told the *FT*.

■ The European Bank for Reconstruction and Development (EBRD) has agreed a \$240 million sovereign loan with Uzbekenergo to help build a 900 MW combined cycle gas turbine (CCGT) power plant. The new plant will be located at the site of the existing Talimarjan power plant and will help to support economic growth. The project will be co-financed with the Asian Development Bank (ADB) and the Uzbek Fund for Reconstruction and Development (UFRD).

Kenya backs Lamu project

- Need for Lamu questioned
- Nuclear programme on track

Siân Crampsie

Kenya's government has listed a proposed 1050 MW coal fired power project as one of its priority energy sector projects in the coming financial year.

The Lamu power plant is opposed by climate change activists and international agencies but is included in the Kenyan government's latest list of planned Public Private Partnership projects for the financial period up to 2021.

A draft 2019 Budget Policy Statement released last month by Kenya's Treasury also ranked the coal plant together with the 105 MW Menengai Phase I geothermal as key energy sector projects to be pursued in the current financial year.

Opponents to the plant, to be located in Lamu county, say that it will result in air and groundwater pollution, and also question the need for the additional capacity.

Lamu has been developed by a consortium of firms led by Gulf Energy

and Centum as the local partners with General Electric and the Investment and Power Construction Corporation of China. The consortium – known as Amu Power – has already signed a power purchase agreement with Kenya Power.

Kenya has outlined an ambitious plan to build 3000 MW of new power generating capacity over the next five years but Kenya's Energy Regulatory Commission (ERC) has voiced concerns that electricity supply will outstrip demand and lead to higher energy prices.

ERC recently said that by 2024, power producers in Kenya could be running at 43 per cent of generating capacity, largely because of new renewable energy projects being brought on line. It has advised that a number of power projects – including Lamu – should be delayed.

In December 2018, President Uhuru Kenyatta broke ground for the construction of the 83 MW sixth phase of the Olkaria 1 geothermal energy project. Earlier in 2018 the

300 MW Lake Turkana wind farm was commissioned.

Kenya is also in the process of developing nuclear energy.

Last month the Kenya Nuclear Electricity Board (KNEB) said it had concluded the process of analysis and selection of potential sites for Kenya's first nuclear power plant.

KNEB said that it has identified locations around Lake Victoria, Lake Turkana and the Indian Ocean as potential sites for the first plant due to their sustainable water sources.

KNEB Chief Executive Officer Collins Juma said the board is currently conducting a screening exercise for potential sites identified to come up with candidate locations. "The board is in the process of selecting a qualified firm to develop terms of reference for site characterisation for nuclear power plants in Kenya after it closed international tender notice," he said during a stakeholders' dialogue forum in Kisumu.

Kenya's first nuclear plant could be on-line by 2027, KNEB said.

Egypt delays wind tender



A tender for the construction of a 250 MW wind farm in Egypt has been delayed at the request of two bidding companies.

Egypt's New and Renewable Energy Authority (NREA) said it had agreed to delay the deadline for receiving bids for the Gulf of Suez wind farm to February but that the tender would not be delayed again.

The delay was agreed with the German Development Bank, KfW, which is arranging financing for the project.

Bidders for the project include Vestas, Siemens and Senvion.

The wind farm is one of a number being developed in Egypt by international companies.

NREA said in January that four independent power producers had put in a request for land for the development of wind farms in the Suez Gulf.

The wind farms represent investments of \$500 million and will have a combined output of 400 MW, NREA said.

Bahrain invites solar bids

The Abu Dhabi Future Energy Company (Masdar) is one of several companies to have submitted a bid for the construction of a 100 MW solar power plant in Bahrain, according to government officials.

Dr Abdullhussain Mirza, Electricity and Water Affairs Minister of Bahrain, told reporters in January that tenders for the proposed project have already been received. The project will form a key part of Bahrain's efforts to achieve its renewable energy targets.

According to local reports, the solar

power project will be developed at the Askar landfill site. The project will be one of several solar projects slated for development in Bahrain with a total capacity of 255 MW.

Bahrain has set a target of five per cent renewables in its energy mix by 2025. Overall, it is aiming to have 700 MW of installed renewable energy capacity by 2030.

Renewable energy will not only help the country to reduce carbon emissions, but will also enhance energy security.

UAE nuclear project delayed

The start-up of the UAE's first nuclear power plant has been delayed, according to the plant's operator.

Operations at the \$24.4 billion Barakah power plant were due to start in 2018 but Nawah Energy Company, the operator of the Barakah nuclear energy plant in the Al-Dhafra Region of Abu Dhabi, says that operations are now scheduled to begin between the end of 2019 and early 2020.

Nawah has completed a comprehensive operational readiness review for an updated start-up schedule for unit 1 at Barakah, which is the first of four reactors being built by Korea Electric

Power Corporation (KEPCO) in the UAE.

"The results of Nawah's review forecast that the loading of nuclear fuel assemblies required to commence nuclear operations at Barakah Unit 1 will occur between the end of 2019 and early 2020," Nawah said in a statement.

The Barakah power plant is currently the world's largest nuclear project under construction and will be the first in the Arab world. In December 2018, the Emirates Nuclear Energy Corporation (ENEC) said that construction of the Barakah power plant

was 91 per cent complete.

The four units will together generate 5600 MW of power and are scheduled to be fully completed and operational in 2022.

Barakah One is a joint venture between Emirates Nuclear Energy Corporation (ENEC) and KEPCO.

The UAE will be the first new country to acquire nuclear power in more than two decades. Bangladesh, Turkey and Saudi Arabia are preparing to follow suit and the World Nuclear Association estimates that nuclear power is planned in over 20 countries which do not currently have it.

Shell partnership eyes Eneco bid

- Eneco set for auction sale
- Shell, PGGM boost sustainable credentials

Siân Crampsie

Energy major Shell is considering an investment in Dutch sustainable energy group Eneco as part of its wider plans to boost its role in new and renewable energy.

Shell said last month that it could partner up with Dutch pension fund PGGM to participate in the planned sale of Eneco, one of the largest providers of natural gas and electricity in the Netherlands. It said that it was "impressed with Eneco's achievements in transforming the Dutch energy system through investments in sustainability and renewable energy".

"The energy transition offers good

opportunities for long-term investments in a more sustainable economy and we think Eneco can play a central role in realising the consortium's shared ambitions. PGGM and Shell bring complementary experience and expertise across Eneco's activities, which will support the delivery of affordable sustainable energy to a growing number of customers in northwest Europe," said Frank Roeters van Lennep, Chief Investment Officer Private Markets PGGM.

Eneco's 53 municipal shareholders announced in December 2018 that they would sell the company. The business has been valued at around €3 billion.

PGGM said that it sees sustainability

as a cornerstone of its investment policy for Dutch pension capital, while Shell said that the Eneco business would complement its existing New Energies business unit. "This provides opportunities along the entire energy value chain, from generation of renewable power to trading and delivery at home, on the road and at work," said Shell's Integrated Gas & New Energies Director Maarten Wetselaar.

"Eneco's business neatly fits with Shell's New Energies activities and ambitions to continuously find new ways to reduce carbon emissions and provide more and cleaner energy. The consortium is committed to expand and develop business models that create

both societal and commercial value."

Shell established its New Energies business to create business opportunities in the transition to a low-carbon future and intends to increase its role in the energy transition through investments in offshore wind, solar, e-mobility, and the power sector.

Eneco is expected to be sold later this year via a controlled auction.

Shell has pledged to spend up to \$1-2 billion annually on its low carbon businesses. Its proposed investment in Eneco is another sign that companies heavily invested in fossil fuels are starting to diversify their businesses in order to reduce risk.

Last year Shell invested in UK-based

First Utility, giving it direct access to retail customers in the electricity and gas sectors for the first time.

■ EDF Renewables North America and Shell New Energies US have formed a 50-50 joint venture to develop an offshore wind farm in the New Jersey Wind Energy Area (WEA) off the coast of northeastern USA. The joint venture, called Atlantic Shores Offshore Wind could develop up to 2500 MW in the lease area, located around 15 km off the coast of Atlantic City. The area offers strong and steady wind resources in relatively shallow water, close to large population centers with associated electricity demand.

Virgin backs electricity 'Uber'

A UK-based energy start-up is aiming to become the "Uber of electricity" and has won backing from the Virgin Start-up investment programme.

Resilience Energy wants to turn people's homes into mini power stations capable of meeting all of their own energy needs as having the ability to store and sell energy to others.

Its business model will not only enable homeowners to cut their energy bills by 80 per cent, but will also help the UK to meet its challenging carbon targets, the company says.

Resilience wants to give energy consumers the hardware, software and contracts they need to produce, store and sell energy. The model could also bring more flexibility to the UK's

electricity grid and help it cope with a predicted large roll-out of electric vehicles over the next 25 years.

Virgin Startup has awarded Resilience a loan. The energy company is also working with aggregator KiWi Power to help it manage some of its larger contracts.

Homeowners will pay up to £13 500 to install a Resilience system, consisting of solar panels, a battery and an app, which will have an eight-year payback, the company says.

Resilience Energy is hoping to sell its systems directly to private homeowners as well as through housing providers and constructors, energy suppliers, and EV and charging point manufacturers.



Fires force PG&E into bankruptcy

- Protection will enable management of liabilities
- PPAs under scrutiny

The future of Pacific Gas & Electric (PG&E), one of the largest energy utilities in the USA, is in doubt following its decision to file for voluntary bankruptcy protection at the end of January.

The firm, which serves around 16 million people across northern and central California, said in mid-January that it would file for bankruptcy to help it manage its estimated \$30 billion of liabilities associated with wild fires in California in 2017 and 2018.

The announcement sent shockwaves through the US energy sector, where regulated utilities are generally viewed as a "safe bet" for investors and other stakeholders. It has also prompted discussion about the risks and impacts of climate change on businesses in the energy sector.

PG&E said that Chapter 11 bankruptcy would be the best way for it to address the liabilities while continuing to serve its customers and investing in its infrastructure "in an environment

that "continues to be challenged by climate change".

In a statement, PG&E said: "The company does not expect any impact to electric or natural gas service for its customers as a result of the Chapter 11 process. PG&E remains committed to assisting the communities affected by wildfires in northern California, and its restoration and rebuilding efforts will continue."

An investigation by authorities into the 2017 Tubbs fire recently concluded that the utility's equipment was not the cause of the fire. However PG&E says that it continues to face "extensive litigation" and "significant potential liabilities" associated with wildfires in California.

Its financial position has further been affected by recent credit downgrades to below investment grades, PG&E said. "Resolving the legal liabilities and financial challenges stemming from the 2017 and 2018 wildfires will be enormously complex and will

require us to address multiple stakeholder interests, including thousands of wildfire victims and others who have already made claims and likely thousands of others we expect to make claims," PG&E said in a statement.

PG&E's situation has also affected its many suppliers, including operators of renewable energy projects with long-term power purchase agreements (PPAs). Credit ratings of several suppliers have also been cut sharply, particularly for those plant operators whose revenues are reliant on PG&E contracts. It is possible that PG&E will seek to renegotiate PPA contracts, analysts believe.

An investigation into the 2018 wildfires in California has started. The state has the most stringent vegetation management requirements and clearances in the US and the state's three investor-owned utilities spend more than a billion dollars annually on tree trimming activities, according to the California Public Utilities Commission.

Masdar targets Eastern Europe

Masdar says it will target Central and Eastern Europe's renewable energy sector through a new joint venture with Finnish firm Taaleri Energia.

The two companies recently announced plans to expand an existing collaboration – centred on the western Balkans – into other parts of Europe where opportunities in onshore wind and solar energy are forecast to be "substantial".

Abu Dhabi-based Masdar and Finland-based Taaleri said in a statement that their plans include the Polish onshore wind market, where more than

3 GW of new capacity is expected to be added over the next few years. The two companies also believe there will be opportunities in markets such as Greece and the Balkans, where ageing coal fired capacity will be replaced in the coming years.

Bader Al Lamki, Executive Director of Clean Energy, Masdar, said: "What we've accomplished in partnership with Taaleri in Serbia and Jordan is a testament to the important role that strong partnerships play in unlocking access to renewable energy. We are proud to build on the experiences

gained through our strong collaboration, to help countries in Central and Eastern Europe meet their renewable energy goals."

The JV agreement was signed during the World Future Energy Summit (WFES) in Abu Dhabi.

Taaleri and Masdar already work together on projects in the western Balkans. Among those is the 158 MW Cibuk I wind farm in Serbia, planned to be launched this year. The companies have also joined forces to build a 248 MWp solar park in Jordan, which will be the largest in the country.

10 | Tenders, Bids & Contracts

Americas

SGRE wins Scioto Ridge

Innogy SE has awarded Siemens Gamesa Renewable Energy (SGRE) a contract to supply the wind turbines for the 242 MW Scioto Ridge onshore wind energy project in Ohio, USA.

The contract includes the supply of 63 of SGRE's SG3.4-132 and nine of its SG2.6-114 wind turbines, as well as a 10-year service and maintenance agreement.

Andrew Young, CEO of Innogy Renewables US, said: "Only half a year after the successful acquisition of the more than 2000 MW US onshore pipeline and development team from EverPower and Terra Firma, we have now started executing our first US project."

Commissioning of Scioto Ridge is due to start in late 2020.

Wärtsilä tech supports Argentinian oil

Wärtsilä has been selected to supply a power plant to support operations in one of Argentina's most important oilfields.

The Finland-based company will provide a 57 MW gas fired power plant to power oil fields in the Manantiales Behr basin. It will replace an existing gas turbine-based power plant and will consist of five 31 SG engines. Excess power will be exported to the grid.

The 31SG engine is capable of operating in challenging climatic conditions, Wärtsilä says. The site conditions in the Manantiales Behr basin see wind speeds of up to 180 km/h, and temperatures that can range from -10°C to 40°C. The plant is expected to become fully operational in October 2020.

EDF targets Texas

EDF Renewables North America has signed a multi-year agreement with Phoenix Wind Repower to provide operations and maintenance (O&M) services for three wind projects in Texas, USA.

Under the terms of the agreement, EDF Renewables will offer asset management, balance of plant (BOP) management, remote monitoring, and NERC Compliance Services for the wind projects. The company said that the agreement brings its asset optimisation portfolio in Texas to over 2300 MW.

The agreement covers the 225 MW Trinity Hills wind farm, the 145 MW Sherbino Mesa II project, and the 60 MW Silver Star project, which are currently operating with Clipper C96-2.5 machines. These wind projects are expected to be repowered with Vestas V110-2.2 technology by 2020.

Asia-Pacific

China hubs reach new heights

An order from a customer in China will take Vestas' 2 MW platform to the highest hub heights in the company's history.

Vestas has secured a 101 MW order for 46 of its V120-2.2 MW turbines, which will be mounted on 152 m-high towers.

The towers will be the tallest in China, Vestas added. Delivery and commissioning are expected to take place in the second quarter of 2019.

BHEL wins PV order

Singareni Collieries Company has placed an order with Bharat Heavy Electricals Limited (BHEL) to build 129 MW of solar photovoltaic (PV)

capacity in Telangana, India.

BHEL will construct four PV plants on an engineering, procurement and construction (EPC) basis. The company said that the order is the largest it has ever received for solar photovoltaics.

The plants will consist of a 50 MW site at Ramagundam, 39 MW at Yellandu, 30 MW at Manuguru, and 10 MW at Pegadapally.

Atria Power opts for Suzlon

Atria Power has placed an order with Suzlon for the supply and installation of the turbines for a 50.4 MW wind farm in Tuticorin, Tamil Nadu, India.

Suzlon will install 12 units of S111-140m and 12 units of S120-140m wind turbine generators with hybrid lattice tubular towers, with rated capacity of 2.1 MW each.

The order is the first from Atria Power for Suzlon and is part of the company's letter of intent orders of 484 MW. Suzlon will execute the project on a turnkey basis and will also provide comprehensive operation and maintenance services.

The project will be commissioned in two phases by the first half of 2020.

PowerChina signs coal plant deal

PowerChina has signed two deals with UK-based GCM Resources for the development of a coal fired power plant in Bangladesh.

The two companies have signed a joint venture deal as well as an engineering, procurement and construction (EPC) contract for the new plant, which will be located in Dinajpur district, 338 km northwest of Dhaka.

The power plant will consist of two 1000 MW ultra-supercritical units and is part of a strategy by GCM to install 6000 MW of coal fired capacity in Bangladesh.

Valmet tasked for China EFW plant

Valmet and Urumchi Jinghuan Environmental & Energy Co., Ltd. have signed a contract for the delivery of two boiler plants for a greenfield waste-to-energy plant in Urumchi, China.

The new energy from waste (EFW) plant will use refuse derived fuel (RDF) and will use Valmet's CYMIC boiler technology. The order represents Valmet's largest EFW delivery in China.

Installation of the boiler is scheduled to begin in March 2019. Heat and power production will start by the end of 2019.

Senvion confirms 300 MW Indian job

Senvion has announced a firm order for the 300 MW Bhuj wind farm in the Indian state of Gujarat.

The company will supply developer Alfanar with 131 of its 2.3M130 turbines on a full engineering, procurement and construction (EPC) basis. It will supply the machines for installation in the second quarter of 2020. It will also operate and maintain the facility for more than 10 years.

Microgrid order cheers Capstone

Capstone Turbine Corporation has secured an order for a C200 microturbine that will be part of a Chinese utility microgrid project.

Secured by EED International, a Capstone distributor for China, the system will be used in conjunction

with a hot water absorption chiller in a microgrid optimisation project to supply electricity, hot water and chilled water.

The low-pressure natural gas (LPNG) C200 microturbine, configured in a combined cooling heat and power (CCHP) package, will also have the capability to run dual mode, providing electricity and thermal energy in island mode as well as when connected to the local utility grid.

Europe

BayWa r.e. lands solar O&M deal

BayWa r.e. has secured a contract for the operation and maintenance of 13 UK solar farms on behalf of Octopus Investments.

Under the contract, BayWa r.e. will provide the complete scope of O&M services for 61.1 MW of solar photovoltaic (PV) capacity. It follows a deal signed in May 2018 for BayWa r.e. to take over the technical and commercial asset management of four of Octopus' UK wind farms, with a total output of 149 MW.

BayWa r.e.'s serviced portfolio now stands at over 1.9 GW of utility-scale projects, it said.

The scope to be performed on the Octopus PV sites will include all electrical and non-electrical tasks required for plant management and performance optimisation of the solar farms.

Dresden orders 90 MW CHP plant

Wärtsilä has been awarded a contract to deliver a combined heat and power (CHP) engine-based plant to Dresden, Germany.

The contract was placed by local Dresden utility Drewag and will be executed on an engineering, procurement and construction (EPC) basis. It includes a ten-year operation and maintenance agreement with a five-year extension option.

The Dresden-Reick power plant will feature eight Wärtsilä 31SG engines operating on natural gas delivering electrical output of approximately 90 MW.

The Dresden-Reick plant is scheduled to become operational in 2021.

Valmet wins TSE deal

Valmet is to supply flue gas condensing and asphaltene combustion systems to the NA4 power plant in Finland after receiving an order from energy company Turun Seudun Energiantuotanto Oy (TSE).

The new flue gas condensing system will enable Turun Seudun Energiantuotanto to increase their district-heat production capacity and improve efficiency at the NA4 unit. The asphaltene combustion system will enable TSE to replace coal with an oil refinery byproduct.

Delivery is scheduled to be completed by the end of 2019.

Uniper to build new gas fired plant in Irsching

TenneT has awarded Uniper a contract to build a new gas fired power plant with a capacity of 300 MW in Irsching, near Ingolstadt, Germany.

The contract follows a call for bids issued by TenneT and fellow grid operators Amprion and TransnetBW for the construction of 1200 MW of capacity under 'special grid facilities' legislation in Germany.

The Irsching power plant will be commercially available from October 2022 and will serve as a reserve power plant available for operations at short notice.

Holaluz, EDF Solar sign PPAs

Spanish electricity firm Holaluz has signed a power purchase agreement (PPA) with EDF Solar covering projects in the Iberian Peninsula totalling 120 MW.

Holaluz said that the three-year agreement will help develop several photovoltaic (PV) plants in Spain and Portugal, with a total investment close to €80 million (\$91.16 million).

Holaluz, through a Representation Agreement, will sell the energy generated by the parks to the wholesale electricity market.

There are two plants already under construction, located in Toledo (8 MW) and Oporto (3 MW). Three other facilities are planned to break ground between May and September of this year, in Castilla y Leon (50 MW), Andalucia (40 MW) and Aragon (12 MW).

Double Dutch order for Nordex

Germany-based Nordex Group has received an order from Vattenfall to supply turbines for two wind farms in the Netherlands.

The 22 MW Haringvliet project will comprise six N117/3675 machines, while the 27 MW Moerdijk project will consist of seven N131/3900 turbines. The order also includes a two-year Premium Service contract for both wind farms, with the option of a subsequent extension of 23 years.

The first N117/3675 turbines for Haringvliet are to be delivered in December 2019. Grid connection of the wind farm is scheduled for spring 2020.

The Moerdijk wind farm will be installed in the port and industrial area of the town of Moerdijk, in the province of North Brabant. Completion is scheduled for summer 2020.

International

QPower extends Ras Laffan service deal

Siemens has signed an extension of a long term service agreement with Qatar Power Company (QPower) to maintain and support operations at the Ras Laffan B combined cycle power plant.

Under the 15-year deal, Siemens will provide maintenance, parts and repair services for three SGT5-4000F gas turbines, two SST5-6000 steam turbines, and their associated generators. In addition, the agreement includes the supply of a broad spectrum of the company's digital services and cybersecurity solutions, designed to boost efficiency and reliability of the power plant's operation.

The 1025 MW Ras Laffan B power plant was built in 2006 to meet increasing demand for power and water, as the second independent water and power plant (IWPP) in the country.

Russian success for Vestas

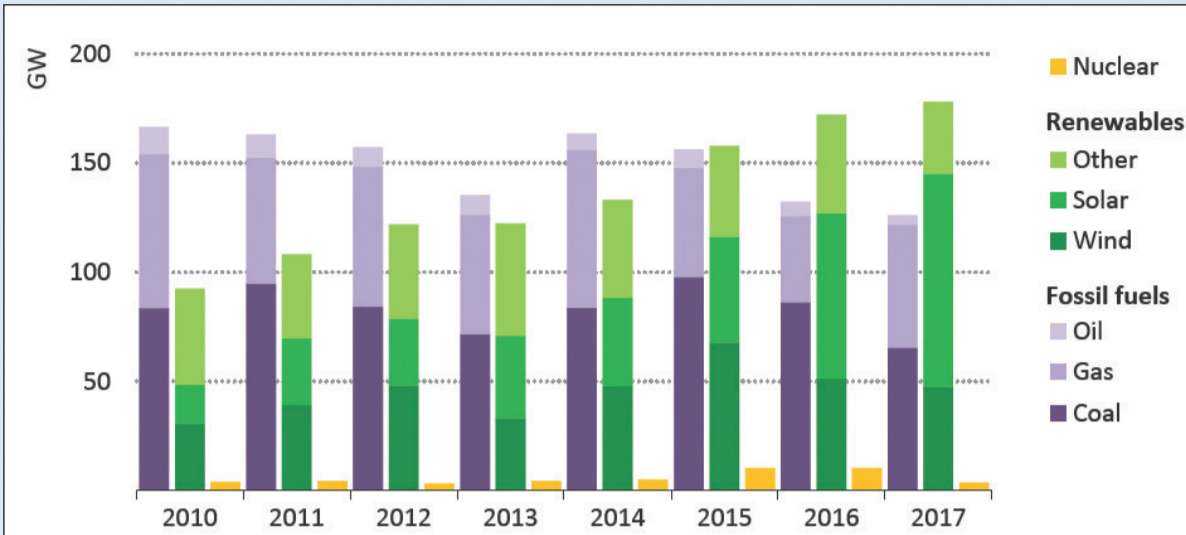
Vestas has received an order to equip a 198 MW wind farm in Russia.

Vestas will supply, install and commission 52 of its V126-3.45 MW turbines in 3.8 MW power optimised mode for the Kamensko-Krasnosulinsky wind farm in Russia's Rostov region. Delivery is planned for the fourth quarter of 2019.

The Kamensko-Krasnosulinsky wind farm will be the largest in Russia and is being developed by WEDF Second Wind Farm LLC, a joint venture between Russian group Rusnano and Finnish utility Fortum Oyj.



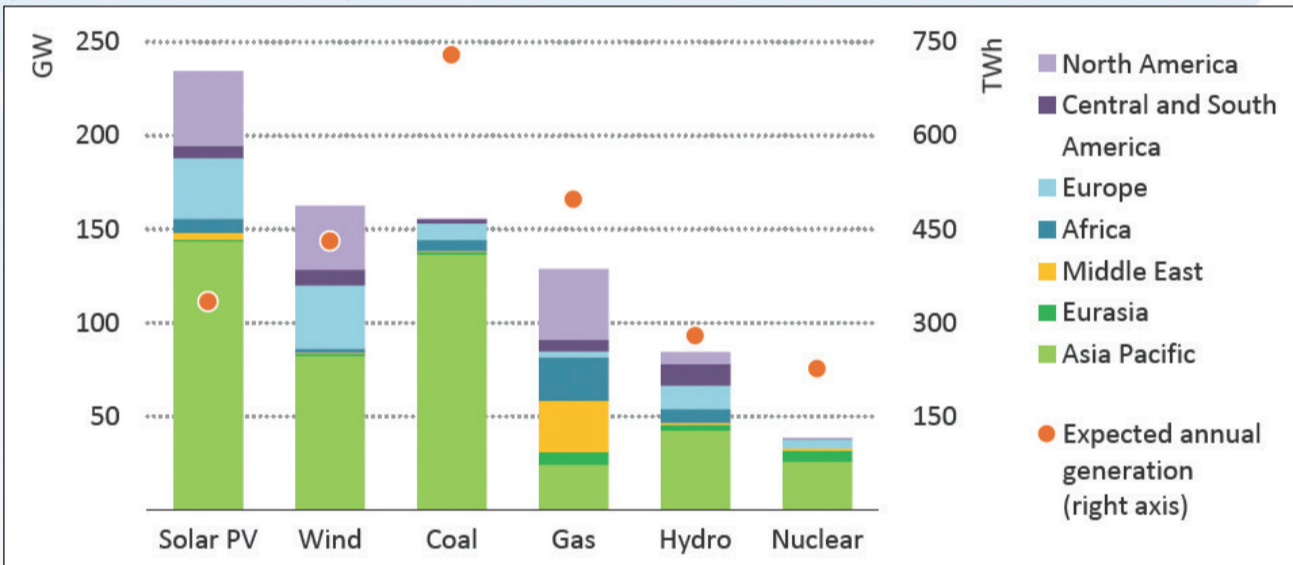
Annual power generation capacity additions, 2010-2017



For more information, please contact:
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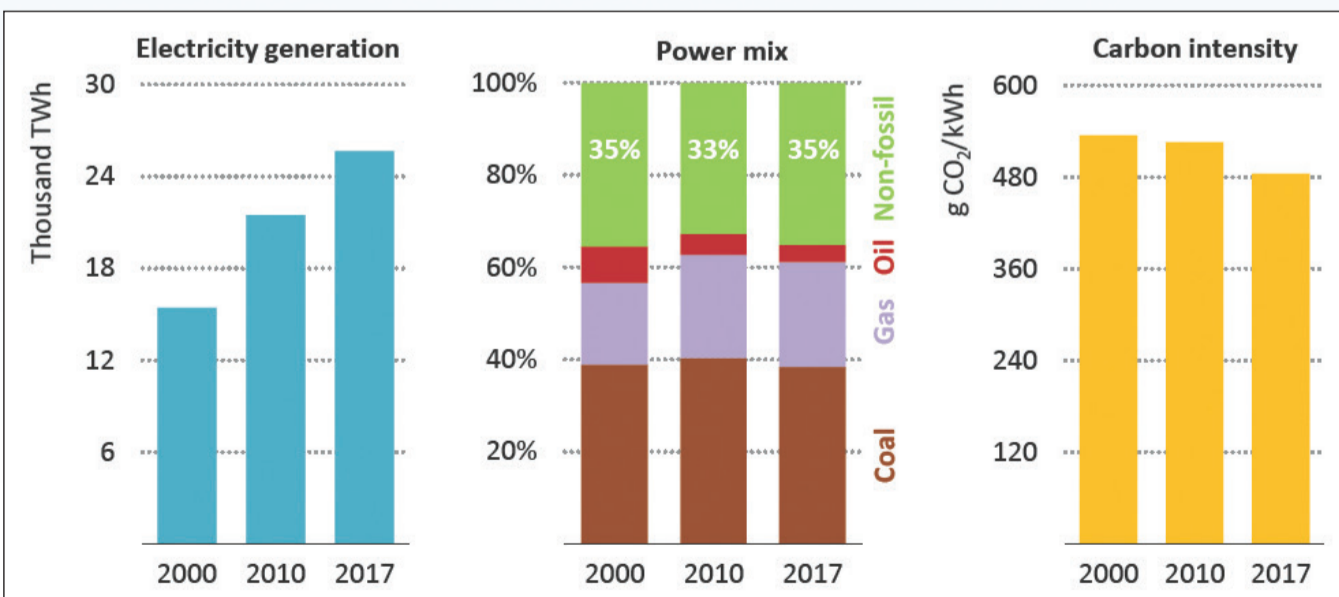
World Energy Outlook 2018, © IEA/OECD, Figure 7.11, page 293

Power plants under construction or expected to 2020 and expected annual generation in 2020 by source



World Energy Outlook 2018, © IEA/OECD, Figure 7.12, page 294

Electricity generation, power mix and carbon intensity, 2000, 2010 and 2017



World Energy Outlook 2018, © IEA/OECD, Figure 7.13, page 295

Oil

US set to become net oil exporter as shale production rises

- Crude production in 2018 up 1.6 million b/d
- Opec+ agrees to cut output by a total of 1.2 million b/d beginning in January

Mark Goetz

As Opec+ (Opec and its non-Opec oil producing allies) launch a second oil production cutback meant to reduce crude volumes on the oil market and grow prices that remain barely above \$60/b, US oil producers, so far unconstrained by falling prices, continue to pump oil at a record breaking pace.

The US Energy Information Administration (EIA) reported in its January 2019 'Short-Term Energy Outlook' that US crude production averaged 10.9 million b/d during 2018, 1.6 million b/d more than 2017, and forecast that US output would hit an average of 12.1 million b/d in 2019 and 12.9 million b/d in 2020, with most of this oil coming from the Permian region of Texas and New Mexico.

This growth in production can be attributed to the shale (or tight) oil sector of the industry. According to EIA data,

on average, US oil output has increased by about 1 million b/d over the last decade and has exceeded previous EIA forecasts for US oil production from several years ago.

Furthermore, the US is set to become a net exporter of crude oil in the fourth quarter of 2020, meaning it exports more crude and products than it imports. While America has long-sought energy independence, becoming a net exporter will not mean that the US will escape the need to import the particular crudes that work in its refineries, but it does mean that its role on the global oil stage will be upgraded, and to that extent, many of the big oil producers such as Saudi Arabia and Russia, partners in the Opec+ effort to rebalance the market and boost prices, will likely have to apply even more discipline.

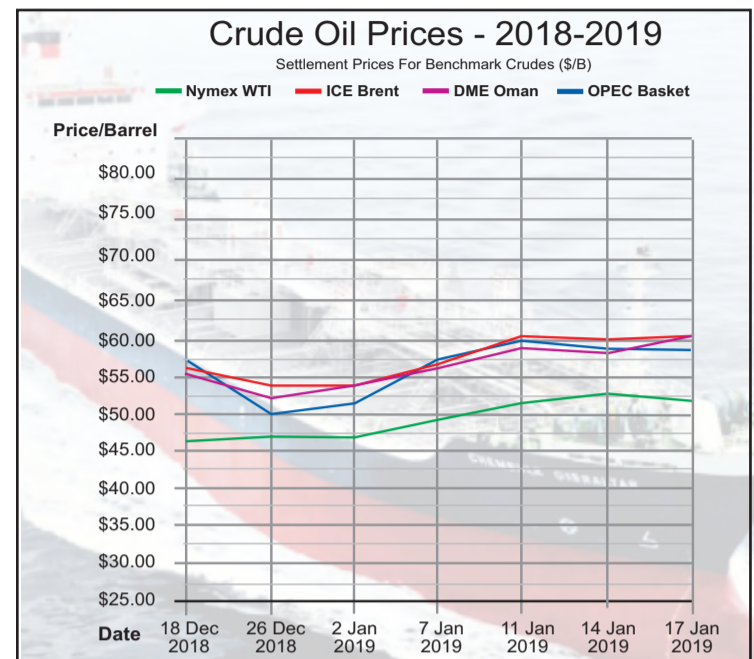
According to the EIA data, US crude oil and petroleum products net imports have declined from an estimated

average of 3.8 million b/d in 2017 to around 2.4 million b/d in 2018. The office estimates that for a short time in November 2018, the US was a net exporter. That is likely to happen again and again intermittently over the next two years, but by 2020 there are strong signals that the US as a net exporter will be the norm.

The EIA forecasts that net imports will fall to average 1.1 million b/d in 2019 and about 0.1 million during 2020. However, by the fourth quarter of 2020, the US will be a net exporter by an average of 0.9 million b/d.

How this will impact Opec+ and the global oil market will be interesting to watch. The US lets the market dictate production whereas Opec+ looks to manipulate output in order to get the best monetary result for its members.

It must be recalled that in 2014, Opec - Saudi Arabia in particular - decided to turn on the oil taps in order to force



cheap oil (US shale oil) out of the market. But cost cutting and new extraction techniques enabled a number of shale producers to survive the shakeout.

It was the folly in this approach that forced Saudi Arabia and its new non-Opec partners at end-2016 to introduce cutbacks designed to remove oil surpluses from the market. Growing production in the US caused Congress to allow American companies to export crude resulting in a need by the US industry to now move forward with new pipelines and infrastructure that will make more US crude available to the global market.

Opec+ met in Vienna in early December and agreed to cut output by a total of 1.2 million b/d beginning in January, but according to data released by Opec this month, the group has already started cutting back on production. During December Opec output fell by 751 000 b/d for a total monthly average

of 31.6 million barrels. Opec's share of the new cutbacks is 800 000 b/d. Its allies are to cut output by 400 000 b/d. Opec leader Saudi Arabia is expected to make further production cuts of its own in the months ahead.

The level of output from the US "will once again be a major factor in 2019", the International Energy Agency said in its latest monthly report. "We saw incredible and unexpected growth in total liquids production of 2.1 million b/d," it said. "For this year [2019] we have left unchanged for now our forecast for growth of 1.3 million b/d. While the other two giants [Saudi Arabia and Russia] cut output voluntarily, the US, already the biggest liquids supplier, will reinforce its leadership as the world's number one crude producer."

According to the IEA, by the middle of 2019, US crude output "will probably be more than the capacity of either Saudi Arabia or Russia."

Gas

East Mediterranean countries move to create Region Gas Forum

East Mediterranean energy ministers met last month to kick-start plans for a gas and energy hub in the region.

David Gregory

East Mediterranean energy ministers and other officials assembled in Cairo in mid-January to launch the creation of an East Mediterranean Gas Forum, the purpose of which is to cooperate and coordinate the development of a natural gas industry and energy hub in a region that is proving to contain significant hydrocarbon resources.

Officials from Egypt, Cyprus, Israel, Greece, Jordan, Italy and the Palestinian Authority endorsed the project and are now studying documents governing the forum. They plan to meet again in April or May to establish it as a viable organisation.

Egypt has long been a gas producer but output declined earlier this decade after the January 2011 revolution. Exports of LNG and gas exports by pipeline were halted in order to direct gas production to domestic consumption. However, over the last two years Egyptian gas output is coming back following legal reforms, reductions in subsidies, changes in licensing contracts and rates of pay to producers.

Egypt recently announced that it is capable of meeting domestic demand and has already resumed exports of pipeline gas to Jordan and LNG from the Idku facility. Talks to restart processing at the Damietta plant are in progress.

The main turnaround for Egypt came with the discovery of the Zohr gas field by Italy's Eni in 2015. The field holds 30 trillion cubic feet (tcf) of natural gas and production from the field will soon average more than 3 bcf/day. By 2020, output from Zohr and several other fields will put Egypt's daily output at around 7 bcf.

Eni is a major player in Egypt's gas industry and it is also the largest investor in offshore Cyprus, where two gas discoveries have been made. Currently ExxonMobil is drilling its second offshore well in Cyprus and Noble Energy is negotiating with Egypt to transport gas from its Aphrodite field to Egypt's Idku LNG plant.

Israel will begin to ship natural gas to private Egyptian firm Dolphus Holdings later this year and initial

agreements to send gas from the Leviathan and Tamar gas fields to Egypt for LNG processing have been signed. This year could see an official accord that will see that happen. Following the Cairo meeting, Israeli Energy Minister Yuval Steinitz said talks were under way to build a subsea pipeline to Egypt to transport Israeli gas.

For Egypt, its goal is to become the East Med energy hub. Imports of gas from Cyprus and Israel that will be re-exported as LNG will confirm that, plus pipeline exports to Jordan through the Arab Gas Pipeline, which two decades ago was seen as a project that would transport Egyptian gas to Jordan, Syria, Lebanon, Turkey, and to Europe. Egypt also wants to boost electricity exports to Jordan, Libya, and soon, Sudan.

For several years Cyprus has been instrumental in organising tripartite meetings between it, Greece and Israel, and between itself, Greece and Egypt. Cyprus has also drawn Jordan into the circle. The Palestinian Authority is involved because Israeli gas

is supplying a West Bank power station. Italy is involved because of Eni and also because a Greek/Italian joint venture, IGI Poseidon, is proposing the construction of a 2000 km subsea pipeline that will cross the East Mediterranean to bring Israeli and Cypriot gas to Europe through Crete, Greece and to Italy. The governments of Cyprus, Greece, Israel and Italy have endorsed the project, as challenging as it may be. The EastMed Gas Pipeline is not expected to really take shape until the early 2020s, but Egypt has expressed an interest in the project too.

Another important project in the works is the Alexandroupolis Independent Natural Gas System (INGS) being carried out by Greece's Gas-trade. The project calls for a floating storage and regasification unit (FSRU) in the northern Aegean that would feed gas into Greece's gas grid, the Southern Gas Corridor and Interconnector-Greece-Bulgaria (IGB) pipelines that will deliver gas to Italy, Europe and the Balkans. Gas from the East Mediterranean, processed at Egypt's LNG plants, is envisaged as being delivered

to that terminal.

Adding to the energy hub mix are the proposed EuroAsia, EuroAfrica electricity cable projects that would follow the course of the EastMed Gas Pipeline. Cables from Israel and Egypt would link up in Cyprus and carry electricity generated in the region to Greece and Europe. This system could be working in a limited degree within a few years.

The East Mediterranean is going to see major economic and infrastructural changes over the next 10 years. Egypt is ideally suited to be an energy hub. It has the geographical location, the Suez Canal and its new industrial zones, a strong gas production sector, plus the infrastructure that neighbouring Israel and Cyprus can use to export their own gas resources. Furthermore, there is much more gas to be discovered. Less than 10 wells have been drilled offshore Cyprus. Israel has just launched a new licensing round. At some point exploration will begin offshore Lebanon. And there is a large area offshore northwest Egypt that has yet to see any exploration.

Euratom: now what?

The potential impact of the UK's withdrawal from the European Atomic Energy Community could have massive impacts. But with the March 29th deadline for Brexit fast approaching, there appears to be only one viable option to keep nuclear commerce open with the EU.

Vince Zabielski explains.

Brexit – and all the ongoing parliamentary wrangling – is seldom out of the headlines. But amidst all the speculation that businesses may be: considering relocating to the mainland; the UK may soon be able to strike new trade deals with the growth economies; and potential agreements on regulatory standards, the potential impact of the UK's withdrawal from the European Atomic Energy Community, commonly known as 'Euratom', is often overlooked.

However, this is a dangerous lapse to ignore. It is, quite literally, a nuclear issue, with an effect likely to be far reaching and profound.

After all, the UK's membership in Euratom provides the framework for bilateral cooperation in nuclear trade between and among the United Kingdom and the other 27 EU states that are party to the treaty, including major equipment and material suppliers such as France, for example. Additionally, through bilateral nuclear cooperation agreements between the European Atomic Energy Community and other states, the UK's participation in the Community provides the basis for nuclear power cooperation with Australia, Argentina, Canada, Japan, Kazakhstan, South Africa, Ukraine, the United States, and Uzbekistan. Once the UK exits Euratom on March 29,

2019, the nuclear cooperation agreements that the UK has through Euratom shall no longer be in effect and shall cease to function.

The UK's post-Brexit nuclear strategy has been to put in place by the end of March 2019 all the international agreements it requires to ensure uninterrupted cooperation and trade in the civil nuclear sector, and to negotiate an orderly withdrawal from Euratom. This entails negotiating a new nuclear cooperation agreement with Euratom, as well as simultaneously negotiating individual agreements with the UK's major nuclear trade partners. Exit from Euratom also requires setting up a domestic nuclear safeguards programme to take over once the Euratom safeguards arrangements are no longer in effect.

Once the UK leaves Euratom, the UK will have the responsibility of ensuring that all ores, source materials and special fissile materials covered by the Euratom Treaty and present in the UK post-Brexit are handled in accordance with applicable international treaties and conventions on nuclear safety, safeguards, non-proliferation and physical protection of nuclear materials, and international treaties and conventions on the safety of spent fuel management and the safety of radioactive waste management.

The good news is that the UK government has reported remarkable progress in setting up a domestic safeguards regime to replace the Euratom safeguards regime and has also made remarkable progress in putting new nuclear trade agreements in place.

The UK is well along the way towards implementing a domestic safeguards system with the equivalent effectiveness and coverage as that previously provided under Euratom.

The new State System of Accounting for and Control of Nuclear Material (SSAC) will be administered by the Office of Nuclear Regulation (ONR) and will ensure that the UK continues to meet its international non-proliferation commitments in the post-Brexit world. The ONR is developing a regulatory framework to implement the SSAC, including a new information system capable of processing nuclear material accountability reports. The ONR will also need to hire and train safeguards inspectors, nuclear material accountants, and safeguards officers to administer these new systems and to ensure compliance with the SSAC.

In addition to developing the new domestic safeguards regime, the UK has also made astounding progress in putting new nuclear cooperation

agreements in place with major supplier countries.

In hindsight, there was little to be optimistic about regarding a "soft landing" for the UK nuclear industry after Brexit. Getting all the necessary third-party cooperation agreements in place, especially considering the resources necessary to negotiate the terms and conditions of the larger Brexit from the European Union, was an extraordinarily ambitious undertaking, and one that was received with a dose of healthy scepticism from many observers.

Past implementation of treaties with Euratom and third parties have proceeded at a glacial pace and, given the hostility that the EU has shown to the UK at times during the Brexit process, there were few signs of hope. Not helping matters, Barack Obama, the former President of the United States, starkly warned that the UK would be at the "back of the queue" in any trade deal with the United States if the country chose to leave the EU.

Despite generally low expectations for success, the UK government has made good progress on reaching new nuclear cooperation agreements with many of its non-EU trading partners. A new agreement between the UK and the United States was signed on May 4, 2018, and received US Congressional approval in August 2018, and that agreement is now before Parliament for final approval.

Likewise, new nuclear cooperation agreements have been agreed with Australia and Canada, which are both major suppliers of nuclear materials to the UK. Negotiations to update the existing nuclear cooperation agreement with Japan also appear to be on-track. Meanwhile, nuclear cooperation agreements with China and Russia continue to remain in effect, and the UK continues to discuss arrangements for ongoing cooperation with countries where nuclear agreements are not a requirement but are nonetheless currently in place through Euratom, such as Kazakhstan and Uzbekistan, which are both major global suppliers of uranium.

However, an orderly exit from Euratom requires more than developing a domestic nuclear safeguards regime and putting a handful of nuclear cooperation agreements in place, as these don't address the "unwinding" of the UK from Euratom. Nor do any of the nuclear cooperation agreements that have been put in place provide for nuclear trade between the UK and the EU. Nuclear commerce with key European trading partners, France most notably, will be interrupted unless and until a new treaty between the UK and Eur-

atom is put in place. The UK negotiated a comprehensive Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community ("Withdrawal Agreement"), but that agreement was soundly defeated by Parliament in the 15 January 2019 "meaningful vote" on Brexit.

While there are many criticisms to be made of the Withdrawal Agreement, one thing it did do very well was orchestrate a deliberate and methodical exit for the UK from Euratom, while maintaining security and safeguards standards at their current levels. To be clear, both the EU and the UK appear to agree on virtually every aspect of the UK's withdrawal from Euratom, down to the last detail. So, what is the problem?

Exasperatingly, even though the details of an orderly exit from Euratom have been worked out, the current Euratom exit deal is being held hostage to the overall Brexit "deal". Unfortunately, with each passing day, hope of securing any kind of deal – even a bad one – seems increasingly unlikely.

With the Brexit deadline fast approaching, there appears to be only one viable option to keep nuclear commerce open with the EU: split exit from Euratom from the larger Brexit agenda. This would require the UK to forgo its current "all or nothing" approach and introduce legislation to carve out the Euratom deal for separate approval by Parliament. Separating exit from the European Union from exit from the European Atomic Energy Community would ensure that the nation's nuclear commerce continues to operate during an orderly transition from Euratom, and while this may not be a headline-grabbing title akin to the Irish backstop or customs union, it would allow a largely unseen, but vital, UK sector to continue functioning.

Ensuring a safe and orderly exit from Euratom is necessary to protect nuclear energy generation both in the UK and EU, but finalising an agreement has been overshadowed by the larger Brexit debate. With agreements in place, or largely negotiated, with the almost all UK nuclear trading partners, the lack of a Euratom agreement is notable. Solving this issue would help prevent a costly dilemma in the long run but, perhaps of more interest to the government, it would also demonstrate that the government is capable of solving problems, even if just one at a time.

Vince Zabielski is a former nuclear engineer and now partner at the international law firm Pillsbury.

Zabielski: the current Euratom exit deal is being held hostage to the overall Brexit "deal"



Preparing for a smarter world

As Distribution Network Operators prepare for an energy market that is much more distributed, with customers requiring different services, *TEI Times* caught up with Northern Powergrid's **Jim Cardwell** to discuss the challenges and pathways to addressing the needs of the future.

Smart, flexible networks are essential in managing the transition to energy systems that have an increasing amount of intermittent renewables, electric vehicles, heat pumps, energy storage systems and other distributed energy sources. They are also crucial to consumers playing a much greater role in how networks are actually managed.

However, there are several key challenges to the development of smart grids and to distribution network operator (DNOs) transforming themselves from DNO to distribution system operator (DSO), i.e. moving from a company that is only responsible for keeping the lights on and connecting customers to the network, to one that offers customers services that go beyond just supplying electricity and rewarding them for playing a more active role in supporting the network.



Cardwell: The biggest challenge is accommodating the changing energy practices of our customers

Northern Powergrid is a DNO that looks after the electricity distribution network across the Northeast, Yorkshire and Northern Lincolnshire in the UK. In its recent report, 'DSO v1.0 next steps and emerging thinking', published just before Christmas, the company outlined its progress in what it calls "a customer-led transition" to a DSO.

Essentially, Northern Powergrid has been laying the foundations for its transition through an ongoing roll-out of smart grid technology and by enhancing data systems to build a future-proof local network

around the need of its customers.

Commenting on what he sees as the three biggest challenges facing networks and DNOs today and going forward, Jim Cardwell, Head of Policy Development at Northern Powergrid said: "The biggest of the challenges is accommodating the changing energy practices of our customers, which are largely driven by the whole decarbonisation agenda, and doing that at least cost.

"The second is, even if there was no decarbonisation, we would still be expected to deliver more for our customers for less cost... and we are competing with the likes of Amazon and First Direct in terms of the quality of our customer service. The big thing for us is making sure we keep the lights on and have fewer or shorter duration power cuts for less cost.

"The third thing is what I would call 'new risks'. The whole cyber security issue is one that keeps us going at the moment. The difficulty with using smarter technology is that you potentially open yourself up to new risks. We've seen high profile cases of electricity grids being targeted by those that want to do harm. So it's all about investing in security systems and our people, so we don't expose ourselves and customers to that risk."

Becoming a DSO means adopting new commercial practices and technologies. It requires investing in new skills, increased stakeholder engagement and greater scenario planning to cope with uncertainty and opting for least regrets investments. In addition, and maybe most importantly, it calls for innovation.

Northern Powergrid has several notable programmes that are central to its transformation, perhaps the biggest being its work in smart grids.

A smarter network is an essential precursor to a smarter energy system to fully realise the benefits of becoming a DSO. Northern Powergrid has therefore launched its £83 million (\$109 million) Smart Grid Enablers project. The company says it is the UK's most comprehensive network upgrade programme and will transform its ability to monitor, control and communicate with more than 860 substations.

Cardwell commented: "Our Smart Grid Enablers programme is the biggest change to our network since the 1970s. It's a massive piece of work that's about ensuring we're ready for, potentially, high levels of electrification of heat and transport beginning in the 2020s."

Under the programme, Northern Powergrid is upgrading the control units in the substations to make the network compatible with modern digital communications, along with establishing the communication network from its control centres to those

units.

The work will give the organisation the ability to respond to real-time information about power flow on its network and build new capabilities that will enable it to roll out smart grid solutions that could generate up to £350 million of benefits by 2031.

"This was in our business plan for the 2015-23 period and we are already well on with this implementation," it stated in the report. "We are also getting on with the transition by implementing flexible solutions where it makes sense to do so."

Another key project is the roll out of "customer flexibility solutions", which will be implemented where possible instead of long-term asset solutions. The plan is to combine network flexibility solutions with customer flexibility solutions to maximise the use of the existing assets that make up the local grid.

According to government analysis, using flexibility is the best way to develop the electricity system, limiting network upgrades, enabling more renewable generation, and offering UK consumers estimated savings of £17-£40 billion by 2050.

Northern Powergrid expects its need to procure flexibility to grow over time with increased renewable generation, increasing numbers of EVs and changing consumer behaviour. Last year it assessed the network for areas where intervention may be required to manage peak congestion in the period to 2023.

This year, for the first time, it is looking for customers to provide up to 12.5 MW of flexible capacity for winter 2019-20 at nine locations on its network. The hope is that it will be more cost effective to pay them to reduce demand at key times than to spend money on upgrading the network. Further, it believes that in the future, customer flexibility could also provide emergency support during power cuts.

Northern Powergrid will trial new commercial offerings and contracts and explore platforms on which flexibility will be traded. Having set its DSOv1.0 immediate next steps and emerging thinking, the company says it will consult with stakeholders to develop and refine processes.

It then intends to update that detailed plan twice a year. This work will also directly inform its business plan, including the business plan that it will publish in 2021, which the energy regulator will use in determining Northern Powergrid's regulatory settlement for the period running from 2023-28.

A number of innovation projects are also ongoing – solutions that work for customers, regional and national networks and take into account heat and transport. These projects for example,

make use of data analytics, sensing technologies and even EVs to shorten outages and boost resilience to power cuts.

With Nissan and National Grid, it is running a world-first £9.8 million trial exploring how EV batteries can support the grid when plugged in for charging. e4Future will use 1000 vehicle-to-grid chargers and evaluate a commercial offer for EV fleet customers. It is collaborating with Northern Gas Networks on InTE-GReL, the UK's first incubator for integrated energy system technology. Northern Powergrid is also exploring how heating systems can be used to help balance power demand and how gas storage could support the electricity system.

The report also highlighted that its Active Network Management (ANM) solution at Driffield in Yorkshire is providing scalable capability to connect more generation at least cost as an alternative to conventional reinforcement. The Driffield ANM scheme is on a 66 kV section of the network that is considered to be operating at full capacity in relation to embedded generation connections.

Through ANM, Northern Powergrid will be able to actively manage exports from generation customers in order to provide them with cost-effective connections to the distribution network.

It says it is planning to roll out further ANM zones, where there is high customer interest in connecting to the network, limited capacity and high reinforcement costs.

Another key area is smart meters, where Northern Powergrid is upgrading its systems and processes in line with the national smart meter roll-out programme.

"We are doing this for two reasons," said Cardwell. "Firstly, we want to deliver a better real-time response to power cuts and keep the lights on better. And secondly, we want to use the [smart meter] data to provide more efficient network planning; we want to save money for customers by using that intelligence we haven't had before so we only spend money where we need to."

The role of the future DSO is no small task but Cardwell believes that DNOs are best positioned to take it on. The task of making the transition is therefore high on the agenda of most network operators. He summed up: "The transition is going well. It is a massive task in our organisation; it's one of the top five things we are doing. We have a lot of initiatives going on at the moment but this is one of the biggies. It can have a transformational effect for our customers and impact a lot of what we do, so it's getting major organisational focus."

Audi has been using climate-neutral 'e-gas' from a methanation reactor developed by MAN Energy Solutions at its plant in Werlte, Germany

Ramping up power-to-X

MAN Energy Solutions is developing a 50 MW system that will allow electricity from wind and solar to be used to produce synthetic gas that could not only serve as a form of energy storage but could also be used to decarbonise the industry and transport sectors. **Junior Isles**

Power-to-gas uses renewable energy to produce hydrogen and oxygen via electrolysis. CO₂ is added to the hydrogen in a methanation reactor that uses a catalyst to turn hydrogen (2H₂) and carbon dioxide (CO₂) into methane (CH₄)

The falling price of electricity from wind and solar is presenting all manner of possibilities for decarbonising the global economy. In addition to directly eliminating carbon dioxide emissions by avoiding the burning of fossil fuels, wind and solar can also be used in 'power-to-X' (P2X) systems. This is the possibility of converting renewable energy, for example, into methane gas (power-to-gas) or liquid methanol (power-to-liquid). The resulting carbon-neutral synthetic gas can easily be transported through existing gas pipelines and used in gas-powered engines.

It is a technology that MAN Energy Solutions believes has great potential, and one that complements its traditional engine manufacturing business. Over the last several years, the company has been developing the technology to the point where it says it is now ready to offer a 50 MW plant solution.

Commenting on the drivers behind a technology that has been slowly gaining traction globally, Marc Grünwald, Head of Business Development and new energies at the Power Unit of MAN Energy Solutions, said: "The challenge for the future is producing energy while reducing your CO₂ footprint. Traditionally, the approach has been to improve the efficiency of fossil fuelled plants. But today, you can produce electricity from wind and solar at below €6 c/kWh and lower. Renewable generation and electricity demand do not always match, which is why storage solutions are essential. Batteries are ideal as short term storage, but storing the energy as a liquid or gas through power-to-X

allows unlimited storage both in terms of amounts and time."

According to Grünwald, such a technology can make sense in the right setting. Germany has been a leader in the deployment of P2X facilities. Of the more than 30 installations in Europe, approximately 20 are in Germany, says Grünwald. "The biggest of these is the one we built with Audi in 2012/2013," he noted.

Since the summer of 2013, the German car manufacturer has been using climate-neutral 'e-gas' from a methanation reactor developed by MAN Energy Solutions at its plant in Werlte. According to MAN Energy Solutions, the prototype plant is the first installation on an industrial scale to convert excess electricity generated from wind into e-gas and is currently the largest of its kind worldwide.

Power-to-gas basically uses renewable energy that cannot be fed into the grid to produce hydrogen and oxygen via electrolysis. At the Audi Werlte plant, CO₂ is added to the hydrogen in a methanation reactor supplied by MAN Energy Solutions. The methanation reactor is a fixed-bed type and uses a catalyst to turn hydrogen (2H₂) and carbon dioxide (CO₂) into methane (CH₄).

As part of the Volkswagen Group, Audi was among the first of the car companies in Germany to look at 'green' gas-powered vehicles. Volkswagen has around 17 models within its group – including Seat and Skoda – that run on gas.

"Audi had these gas powered cars already and was looking to make the fuel green for its customers," said Grünwald.

The CO₂ for the methanation is captured by amine gas treating from a nearby biogas plant. Per MWh input into the electrolyser, about 35 kg of synthetic natural gas (SNG) can be produced.

The Audi e-gas plant produces around 1000 tons of SNG per year, enabling 1500 natural gas-powered cars to drive 15 000 km on CO₂-neutral gas each year. In addition, the plant absorbs around 2800 tons of CO₂ in the methanation process. This corresponds approximately to the amount that a forest absorbs with over 220 000 beech trees per year.

Having successfully installed the 6.2 MW plant for Audi, MAN Energy Solutions is now looking to build units of up to 50 MW (electrolyser input) for other industrial clients and applications. With the e-gas from a plant of this size, 19 800 natural gas-powered cars could each drive 15 000 km annually.

Carbon-neutral synthetic gas is seen as a very important future energy carrier, which is not only perfectly suited for cars and trucks, but also for public transport and even ships. And this is where the real future of power-to-x probably truly lies – in the decarbonisation of industry and transport.

"More than 50 per cent of the ships around the world have engines from MAN," noted Grünwald. "If you look at these large vessels, you cannot go with batteries because they are too heavy. And you cannot go with hydrogen because it requires too much space to store it. Power-to-X allows us to green-up the fuel and enable the maritime industry to meet its CO₂ goals by 2050."

With regards to the 50 MW size, he said: "There are huge markets for power-to-x and if we do not start delivering this solution to decarbonise industry, we will not achieve CO₂ reduction targets. We are pretty open to delivering whatever our customers are looking for but you need to have some kind of standardisation. So we said we want to deliver in the range of 2 MW to 50 MW. If we do not start now, we are losing years."

Over the last six years, MAN Energy Solutions has been working on improving the methanation process, moving towards what it calls 'methanation 2.0'. The aim is to increase efficiency, improve operational flexibility, reduce costs and footprint, etc.

The company has a research site in Deggendorf where it is developing and manufacturing reactor systems for the chemical and petrochemical industry, refineries and research projects in physics. MAN Energy Solutions says it has already delivered more than 750 reactor systems to customers worldwide,

noting that its reactors can be used for more than 80 different chemical and petrochemical processes. These processes can be tested in the Deggendorf laboratory on a small scale and improved before running on a larger scale.

For power-to-X specifically, in the laboratory it has built a small-scale methanation reactor where researchers are continuously improving the methanation process, i.e. improving the efficiency of the catalysation of the two raw materials, hydrogen and carbon dioxide, into methane. Testing includes different reactor temperatures and pressures, as well as performance tests with different catalysts.

Grünwald commented: "At our site in Deggendorf, MAN Energy Solutions is heavily involved in the development and research of synthetic fuels – a future market with great growth opportunities. There we have our own research. In pilot reactors, chemical syntheses are tested on a small scale (gram to kilogram volume) in order to produce the desired product quantity with the lowest amount of raw materials used."

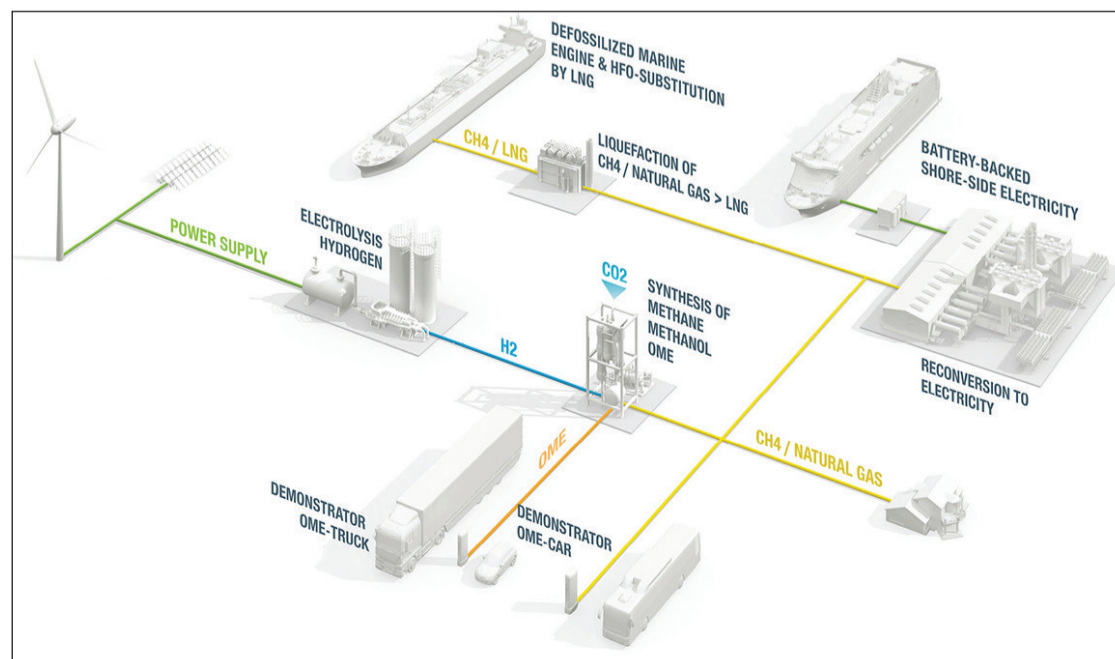
He added: "The new methanation reactor is now two thirds smaller and 30 per cent cheaper (in terms of investment costs) than its predecessor in Werlte and all this with improved gas quality."

Notably, the reactor in Werlte measures 8 m long x 4 m wide x 15.5 m high. Today, that same reactor would have dimensions of 6 m x 4 m x 7.5 m. Meanwhile, the process design of methanation 2.0 enables product gas compositions of more than 95 per cent methane content (up from 92-95 per cent). This makes it suitable to feed into natural gas grids, which, says the company, means all relevant applications can be addressed that run on natural gas today.

"Longer residence times within the reactor can improve this number, but with the [higher] cost of larger reactors or lower output rates," said Grünwald. "Higher gas purities can be achieved with gas treatment measures downstream the methanation itself."

MAN Energy Solutions says it will continue developing the power-to-X technology with the knowledge that there are not many other real options for decarbonising industry and transport, and says it is ready for the market.

Grünwald concluded: "There is huge interest and we already have a couple of leads – my hope is that we will sell the first one this year. The concept for the 50 MW P2X complete solution is ready to offer and we could start a project for a customer tomorrow."





Junior Isles

No will for UK nuclear

They say, where there's a will there's a way. Not in the case of Wylfa. Like Moorside, the planned UK nuclear project has lost its way; once again demonstrating the changing dynamic of the global energy landscape.

In January, Japanese company Hitachi halted plans for its £20 billion (\$26.4 billion) project on Anglesey island, Wales. It also said it was abandoning its other planned UK nuclear plant, at Oldbury-on-Severn in Gloucestershire.

As with Toshiba's Moorside and other large nuclear projects, the cost of building the 2.9 GW Wylfa project has proven too high for the private sector to take on without sufficient government support. The UK government was only prepared to offer a strike price of about £75/MWh with a price below £60/MWh for later reactors on

the site. This is significantly lower than the £92.50/MWh that EDF managed to secure for its Hinkley Point C plant.

In a statement, Hitachi said: "Despite the best efforts of everyone involved, the parties have not been able to reach an agreement. As a result, Hitachi has decided to suspend the project at this time from the viewpoint of its economic rationality as a private enterprise."

Toshiaki Higashihara, Hitachi's Chief Executive, said: "A freeze means we will not put in any additional investment." He added that the company would only renew its involvement if the project was kept off Hitachi's balance sheet, required only a limited capital investment from the company and offered the prospect of an adequate profit.

Although Higashihara says the project is frozen, in reality it is as good

as dead. Hitachi has plenty on its plate in terms of strengthening its balance sheet, and rhetoric from the UK government strongly indicates it is highly unlikely to shift position on Wylfa.

The acquisition of ABB for \$6.4 billion in December has no doubt put a strain on Hitachi's balance sheet and the company will now have to write-off ¥300 billion (\$2.8 billion) for activities related to Wylfa. The company has now cut its net income forecast for the year to March 2019 from ¥530 billion to ¥230 billion, reflecting the scale of the loss.

Commenting on the Wylfa news Rebecca Long-Bailey MP, the shadow business secretary, said suspension of Moorside and Wylfa left a "6.3 GW hole of low carbon energy – 13 per cent of the UK's electricity". But does it really?

If it wants to continue its pursuit of large scale nuclear, the UK could, theoretically, turn to China or even Russian companies, which are keen to provide financing for their projects. Alternatively it could decide to build more gas fired plant or accelerate its expansion of renewables. Despite constant reassurances – throughout and after the protracted negotiations with EDF over Hinkley – that it is committed to nuclear, it seems the latter is becoming the government's preferred option.

In a letter published in the *Financial Times*, Greg Clark, Secretary of State, Department for Business, Energy and Industrial Strategy said the global energy market is changing fast and that cleaner sources of power, such as offshore wind, have fallen in cost to the point they will soon need no public subsidy.

"In this context, Britain's electricity requirement for the 2030s is not a problem of shortages but the much better challenge of abundance. In fact, the last contract for difference auction in the UK procured 3 GW of offshore wind – equal to the capacity of a nuclear power station – for only £57.50 per megawatt hour," he wrote.

Still perhaps paying lip service to the government's commitment to nuclear, or at least attempting to keep the door open to nuclear developers, he said the UK remained "committed to nuclear power" as part of a diverse energy mix. Further, he noted that "Hinkley Point C is proceeding apace and other projects, including Sizewell C and Bradwell, are progressing through the regulatory process". He also stated that small modular reactors can have a role to play.

Notably, however, he stated that "none of these can be at any price". This, he wrote, has led to the decision to "set limits on consumers' and taxpayers' exposure to the costs of Wylfa, and the work being done to reduce financing and construction costs for new nuclear".

The UK government has long been warned that the cost of its programme for 16 GW of new nuclear capacity makes little economic sense, but is only now heeding the warnings – unfortunately at great cost to the private developers that have already made substantial investment in time and money into the projects.

In fairness, few could have predicted the rate at which the price of electricity from wind and solar would fall. Reducing costs and the emerging ability of developers to pitch new projects as purely merchant propositions presents a strong case for a re-balancing of long term UK energy policy.

Clark indicated that this would

likely be the direction of travel for the government. He said that a White Paper to be issued this summer will build on the 'Cost of energy' report produced by economist Professor Dieter Helm for the government in 2017, and his own November 2018 speech "After the Trilemma".

Clark said that developing technology and changing economics meant power could be produced from a wider range of sources than ever and that rather than stick to an approach that was put together a decade ago, the government's policy should allow "taxpayers and consumers to take advantage" of developments.

It will be interesting to see what the White Paper proposes and whether the government decides to forego any significant support for big nuclear projects going forward. Neither Clark's speech nor Helm's report picked winners. Helm's review essentially said consumers were paying too much for energy and that the best way to achieve carbon targets is to set a carbon price with all technologies ultimately competing on a level playing field in terms of government support, with feed-in-tariffs and other low-carbon Contracts for Differences being gradually phased out.

Helm's report did note, however, that in the case of nuclear, the nature of the costs, the time horizons, and the societal decisions about risk and waste "make these investments always a matter for the state".

It says: "Unless there is a market belief that fossil fuel prices will rise very sharply, and the markets are prepared to offer long-term contracts to match such projections, nuclear will not be developed by the competitive markets. The government therefore needs to decide whether and how to proceed".

If the government does decide that large nuclear projects are essential in the energy mix, it will have to find a solution that does not burden taxpayers. The Department for Business, Energy and Industrial Strategy has already said it is reviewing alternative funding models for future nuclear projects and will update on these findings in summer 2019.

Clark confirmed that the government is now considering funding nuclear power stations using what is called regulatory asset base (RAB), and would issue a report before the summer. Essentially, the RAB model mitigates the construction risks by enabling investors to receive returns before projects have been completed.

In a research note, Wood Mackenzie's Europe Power and Renewable team stated: "While the government may still consider alternative funding models and new modular reactor technologies as means of delivering nuclear power, it would appear increasingly prudent to evaluate wind, solar and decarbonised thermal sources, particularly gas, as the mainstays of future power generation."

With the UK's nuclear programme hanging by a thread, the rest of the world will be watching closely to see how this saga plays out. Finland's Hanhikivi 1, although delayed due to regulatory approval issues shows there are ways of financing big nuclear projects (but does little to guarantee they are built to time and budget). And there is always Chinese money waiting in the wings.

The government may have no will for Wylfa but still has to address the real question of whether it wants, or needs, to be in the business of ensuring the future of large scale nuclear at all.

Sire, before you kiss her, think how expensive she will be as a consort – especially considering that there are other maidens to choose from

