

# THE ENERGY INDUSTRY TIMES

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## Taking charge?

Electricity infrastructure developments are under way to accommodate electric vehicles but a huge amount of work remains to be done. **Page 13**



## SMRs can wear the nuclear crown

Small modular reactors could answer many of the problems facing the nuclear industry. **Page 14**



## Final Word

Flying too close to the sun has its hazards, says Junior Isles. **Page 16**



## News In Brief

### EU Parliament strengthens clean energy ambition

The European Parliament's vote to strengthen its clean energy targets through 2030 has been largely welcomed but some believe more could be done. **Page 2**

### US solar import tariffs threaten market growth

Tariffs on imports on solar components into the US could slow the growth of the solar market, according to industry experts. **Page 4**

### Japan looks offshore to cut emissions

Japan is looking to set rules to promote wind power generation as it attempts to boost renewables targets and meet its Paris climate pledge on carbon emissions. **Page 6**

### UK's clean strategy is not enough

The UK's Clean Growth Strategy must be urgently translated into action if the country is to meet emissions targets, government climate change advisors have warned. **Page 7**

### Turkey boosts wind capacity

Wind energy capacity is set to grow rapidly in Turkey following successful tenders in 2017. **Page 8**

### Brookfield secures Westinghouse future

Brookfield Business Partners says it hopes to leverage Westinghouse's strong global market position and diversified customer base after sealing a deal to buy the nuclear firm from Toshiba. **Page 9**

### Technology: Transactive energy on trial

A micro-grid project in Brooklyn, New York, is trialling a peer-to-peer energy trading system. The first transactions were conducted in April 2016 and today, some 50 solar sites are participating in the project. **Page 15**

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# Calls to step up climate action at Davos

Modi: climate change is a major threat right now



India and France call for greater action on climate change, as business leaders point out the opportunities of greening the economy. **Junior Isles**

World leaders and heads of businesses gathering at the 2018 World Economic Forum in Davos, Switzerland, called for increased effort in tackling climate change. The call came a week after NASA declared 2017 the second warmest since 1880.

Last year, it was China's President Xi Jinping who galvanized climate change supporters. This time the lead came from India, as Narendra Modi became the first Indian Prime Minister in two decades to join world business leaders in the Swiss resort town.

Modi said climate change was among the gravest threats being faced by humanity. "Extreme weather conditions are rising by the day and the world should come together. Climate

change is a major threat right now," he stressed.

During his speech at the opening session, Modi outlined his country's progress in meeting its green energy targets.

"To save the environment and to fight climate change, my government has planned a major campaign. By 2022, we want to generate 175 GW of renewable energy. In the last three years, we have already achieved 60 GW or around one-third of this target," he said.

Modi also said India had taken the lead in fighting climate change by setting up the International Solar Alliance – a global group of more than 121 countries, most of them being

'sunshine countries', which fall either completely or partly between the Tropic of Cancer and the Tropic of Capricorn. The alliance's aim is to work for efficient exploitation of solar energy to cut dependence on fossil fuels.

As one of the world's highest carbon emitters, India's action is important but what happens in China is even more critical. China produces more than a quarter of the planet's emissions of global warming gases. Notably, the Davos meeting took place as new figures showed that China's emissions might be rising again.

Yet experts noted that one annual increase does not indicate China is returning to an era when its emissions

grew in leaps and bounds.

"The increase last year is a one-off – it's not likely to be sustained – but Chinese emissions are not likely to go down, either," said Trevor Houser, a partner at the Rhodium Group, a New York consulting group specialising in China.

China has pressed ahead with longer-term efforts to clean up its economy. Last month it announced plans to set up a national carbon trading market. It is also encouraging more use of natural gas.

According to figures released by Bloomberg New Energy Finance in January, Chinese investment in all the

Continued on Page 2

## Regulators squash Trump's plan to "bring back coal"

US President Donald Trump's plan to revive the flagging coal industry is in disarray following the Federal Energy Regulatory Commission's (FERC) rejection of a proposal that would have propped up nuclear and coal power plants struggling in competitive electricity markets.

At the same time, the commission said it shared US Energy Secretary Rick Perry's stated goal of strengthening the "resilience" of the electricity grid and directed regional transmission operators to provide information to help the commission examine the matter "holistically."

In September, Perry sent a proposal to the commission, which has responsibility for wholesale electricity markets, asking it to draw up new regulations to support power generators that were "necessary to maintain

the reliability and resiliency of our nation's grid". He argued that over-reliance on gas fired plants, wind and solar power could risk blackouts in extreme conditions.

Following FERC's decision, Perry said in a statement: "As intended, my proposal initiated a national debate on the resiliency of our electric system."

But most analysts saw the decision as a setback for the administration. "This outright rejection of subsidies for coal and nuclear shows that Commissioners of both parties have little interest in manipulating electricity markets in favour of any fuel source," said Paul Bledsoe, a former consultant at the Obama-era Energy Department, now a lecturer at American University's Center for Environmental Policy.

The decision is a significant blow to

President Trump's attempts to "bring back coal" in the US. Coal fired power plants across the country are being shut down as a result of competition from lower-cost gas fired generation and renewable energy, and the subsidy plan was seen as one of the few potentially viable ways to halt the industry's decline. FERC said last November that by the end of 2020 it expected 74 more coal fired plants to have shut down with a total generation capacity of 20.7 GW.

Coal continues to face strong headwinds, not just in the US but also in other countries where it has traditionally been the mainstay for power generation.

According to the International Energy Agency's recent annual coal market report, global demand for coal would remain nearly flat between

2017 and 2022, resulting in a decade of stagnation for coal consumption.

Global coal consumption fell 1.9 per cent to 5357 million tonnes of coal equivalent (Mtce) last year, the second year of decline, because of lower gas prices, a surge in renewables, and improvements in energy efficiency.

The *Coal 2017* report noted, however, that while coal demand fell in China, the US, and the European Union in 2016, it increased in India and across many parts of Southeast Asia, and shows no signs of slowing down.

In the report, the IEA therefore once again called for urgent action in support of Carbon Capture, Utilisation and Storage (CCUS), the technology that aids clean coal use. "Without CCUS, the climate challenge will be much bigger," it said.

Continued from Page 1

clean energy technologies in 2017 was \$132.6 billion, up 24 per cent setting a new record. The next biggest investing country was the US, at \$56.9 billion, up 1 per cent on 2016. Europe as a whole invested \$57.4 billion, down 26 per cent year-on-year.

French President Emmanuel Macron urged Europe and the rest of the world to do more. In a spirited speech, Macron told WEF delegates: "On climate change, we're losing the battle." He stressed that the world needed concrete action and results by 2020, and announced that France would shut down all coal fired power stations by 2021.

He also called for the EU, which already has an emissions trading scheme (ETS), to "go a little bit further and create a floor price for CO<sub>2</sub>".

Carbon trading markets work by providing a financial incentive to pollute less, but the EU ETS has had limited success in delivering a meaningful price for carbon and many experts have called for a minimum price on carbon to boost progress.



**Macron urged Europe and the rest of the world to do more**

Commenting on China, Macron said: "The new Silk Road has to be a green road. We cannot have a coal-based route."

Business leaders, meanwhile were keen to point out the opportunities that greening the world's economy presents.

Anand Mahindra, chairman of the Mahindra Group, a \$19 billion conglomerate, said that climate change represents a \$6 trillion investment opportunity for businesses over the next two decades.

"Climate change is the next century's biggest financial and business opportunity," he said. "The idea that companies face a trade-off between improving the climate and their growth or profits is a myth," he added.

"Why on earth are we talking about this as a compulsion or a burden? Everything our group of companies has done to try and improve energy (consumption) or to reduce greenhouse gas emissions has given us a return. We have to dispel the idea that there is a trade-off (for business)."

Insurance companies have a vested interest in switching their money away from fossil fuels, according to Thomas Buberl, Chief Executive of insurance company AXA SA. If global temperatures continue to rise, bringing more hazards like hurricanes, droughts and wildfires, insurance companies may not be able to offer cover, he said.

"In my case it's pretty simple... Investing less in coal pays out significantly in cutting the number of claims and in being able to continue providing insurance."

# EU Parliament strengthens clean energy ambition

The European Parliament's vote to strengthen its clean energy targets through 2030 has been largely welcomed by the electricity industry but the heating sector believes more could be done. **Junior Isles**

The European Parliament's (EP) decision to strengthen its clean energy ambition has been largely welcomed by the sector.

In January the EP finally approved the revision of key legislation for the energy sector, namely the Governance Regulation, the Renewable Energy Directive (RED) and the Energy Efficiency Directive (EED), to make them fit for the challenges and commitments of the next decade, up to 2030. The EP also voted for Member States to submit their national energy and climate action plans by June 1, 2019.

The 'Clean Energy for All Europeans' legislative package proposed by the European Commission in 2016 includes initiatives on: (1) the Energy Efficiency Directive; (2) the Energy Performance of Buildings Directive; (3) the Security of Electricity Supply Directive; (4) the electricity market design, consisting in a proposal revising the Electricity Directive and a proposal revising the Electricity Regulation.

Last month MEPs called for a renewable energy target of 35 per cent for 2030, rather than the 27 per cent that the European Commission proposed in 2016 – a decision welcomed by the wind lobby.

Giles Dickson, WindEurope CEO, said: "Good on the Parliament. Thirty five per cent makes sense economically... The difference between 27 per cent and 35 per cent in wind is €92 billion in investments not made and 136 000 jobs not created. And other sectors would miss out too with a lower target: every €1000 invested in wind creates €250 value for the wider supply chain including chemicals, steel and construction."

The new efficiency measures were also greeted positively. Cogen Europe, Europe's umbrella organisation representing the interests of the combined heat and power industry, said the vote sends a strong signal to EU member states to realise the important potential for energy savings at all levels in the energy system.

"Boosting energy efficiency at all

levels in our energy system is key to reducing our carbon footprint and energy bills," said Hans Korteweg, Managing Director at Cogen Europe. "Cogen Europe hopes that the Parliament vote shows clear ambition towards EU member states to make the 'energy efficiency first' principle a core pillar of the energy transition."

Not all, however, are convinced that the Clean Energy Package is as clean as it could be.

The European Heat Pump Association (EHPA) said the vote represents a step back from the ambition shown in November by EP's ITRE Committee towards a more efficient and greener energy system.

It stressed that decisions on the levels of the 2030 energy efficiency and renewable energy targets failed to be backed by an ambitious necessary underlying tool: the primary energy factor. The EHPA said "this small number with big implications" was changed from 2.0 to 2.3 in the plenary vote.

It claimed that keeping the value so

high can only be considered backwards orientated, as the conversion efficiency of Europe's energy system was already 2.11 in 2015 (later numbers are not yet available). Consequently, a value of 2.3 falls short of guiding society into a future where a much larger share of electricity comes from renewable sources.

It noted, however, that the introduction of a new specific sectoral target for renewable heating and cooling in the Renewable Energy Directive was a positive move.

Thomas Nowak, EHPA's Secretary General, commented: "The vote in the Parliament was rather hesitant than ambitious. It strikes me, in particular, that despite the fact that the EU electricity system is greening by the hour, the Parliament refused to recognise this and set an adequate primary energy factor."

"A default value of 2.0 is needed to accelerate the deployment of efficient and renewable technologies and facilitate the transition to a cleaner future energy system."

## Off-grid generation to threaten utility business as early as 2021

- Billions in traditional utility revenues at risk
- US will be impacted at slower pace

It is estimated that it will cost the same to self-generate and store power as it will to buy from an energy provider by 2022 in Europe and as soon as 2021 in Oceania, according to new research conducted by analyst EY.

The data also indicates that electric vehicles (EVs) will reach cost and performance parity with traditional combustion engine vehicles across all markets by 2025.

"Maturing renewable energy technologies, the falling cost of battery storage and more empowered consumer behaviour, have long pointed

toward the emergence of a radical new energy system. While the trends and timelines vary between markets and geographies, the research clearly shows that the countdown to a new energy future is accelerating faster than most expected," said Benoit Laclau, EY Global Power & Utilities Leader.

The findings point to a gap between Europe and Oceania's journey toward energy transformation, and that of the US. The rise of more economical distributed energy resources (DERs) will impact US utilities and consumer preferences at a slower pace than other

markets. This is due to the low cost of generation arising from an increase in utility-scale renewable generation, sustained low cost of natural gas, low levels of taxation in energy bills and less expensive grid maintenance.

Many European countries have already begun to pivot their energy business models in response to regulatory pressure, a faster uptake of renewables and carbon-reduction targets. The findings indicate that \$67 billion in traditional utilities annual revenues will be at risk by 2050 from distributed solar generation in the region.

Across US markets, it is anticipated that annually \$49 billion will be at risk, driven by the west coast (\$26 billion) where state policy is stimulating investment in distributed renewables.

In Oceania countries, \$11 billion annually in revenues will be at risk.

Commenting on how utilities should respond, Laclau advised: "Instead of trying to predict the future of energy innovation, utility companies should focus on building an agile, collaborative business that is ready to quickly adapt to take advantage of new technology and trends."

## EVs and renewables will help emissions plateau by 2030

A report by McKinsey Energy Insights (MEI) finds that major shifts in the energy landscape, particularly related to electric vehicles (EVs) and renewable energy, mean global CO<sub>2</sub> emissions will plateau by 2030.

According to MEI's *Global Energy Perspective* (GEP) on long-term global energy demand, by 2030 every fifth car sold globally will be electric and not just in early adopter markets. Sales of EVs will rise from three per cent in 2020 to 20 per cent by 2030, however the growth in light-duty electric trucks is expected to be slower, growing from one per cent to 12 per cent in the same period.

Renewables are expected to take

almost all the growth in global power generation through to 2050. MEI expects that in the next 5-10 years it will become more economic to build renewable capacity than operate existing gas- or coal-fired power plants in most markets. This will trigger further declines in the utilisation rates of fossil-fuelled plants, with solar and wind growing 5-10 times faster than gas. Overall, the additional global net capacity of power generation to 2050 will be 80 per cent renewables, with China and India contributing more than 50 per cent.

However, despite major growth in the EV market and the increasing dominance of renewables, a rising

population and increasing wealth in non-OECD countries will drive significant energy demand growth, offsetting CO<sub>2</sub> emission reductions elsewhere.

Ole Rolser, Associate Partner and Solution Leader at MEI, commented: "Despite the significant momentum around EVs and renewable energy sources taking an increasing share of the power market, energy-related emissions remain flat from 2030 to 2050. As developing countries continue to rely heavily on cheap coal, non-OECD energy demand will replace the efficiency gains made by OECD countries. To realise the 2 degrees pathway scenario, we'd have to

see much broader, much more disruptive change than what we're seeing now."

New cost analysis from the International Renewable Energy Agency (IRENA) predicts that all renewable technologies will compete with fossils on price by 2020. If these forecasts prove correct, the speed of energy sector disruption is likely to accelerate.

"This new dynamic signals a significant shift in the energy paradigm," said Adnan Z. Amin, IRENA Director-General. "These cost declines across technologies are unprecedented and representative of the degree to which renewable energy is disrupting the global energy system."

**Budhy**  
Fennovoima employee



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# US solar import tariffs threaten market growth

■ Thirty per cent tariff could cost 23 000 US jobs ■ Duty barrier will shock Asian suppliers in near term

Junior Isles

Tariffs on imports on solar components into the US could slow the growth of the solar market, according to industry experts.

In a move to protect domestic manufacturers, the administration of US President Donald Trump has imposed a tariff on solar cells and panels, starting at 30 per cent and slowly decreasing to 15 per cent over a four-year period.

The solar industry predicts the import tax will lead to 23 000 job losses in the country. Abigail Ross Hopper, President and CEO of the Solar Energy Industries Association, said the move "will create a crisis" in a part of the economy that has been thriving, which will ultimately cost tens of thousands of Americans jobs.

Solar developers were also dismayed at the decision. Tony Clifford, Chief Development officer at Standard Solar said: "It boggles my mind that this President – any President, really – would voluntarily choose to damage one of the fastest-growing segments of our economy."

The move has also drawn international criticism. Trina Solar Limited, a global leader in photovoltaic (PV) modules, solutions, and services, said in a statement: "It is an abuse of trade remedies measures. The measures not only give rise to concerns from various trade partners but are opposed by many US local governments and downstream businesses. The US action not only damages healthy and balanced development of the US PV industry, but also deteriorates the global trade of PV products."

China's Head of Trade Remedy, Wang Hejun, expressed "strong dissatisfaction" with the move. He said that "together with other World Trade Organisation (WTO) members, China will resolutely defend its legitimate interests".

South Korea's Trade Minister Kim Hyun-chong also said his government would take the matter to the WTO, adding: "The government will actively respond to the spread of protectionist measures to defend national interests."

Commenting on the impact on Asia, Dr Frank Yu, Asia-Pacific power and renewables principal consultant, Wood Mackenzie, said: "The duty barrier will shock Asian suppliers in the near term and they will likely switch gears to penetrate more into the growing Asian markets to offset

the impact. Years ago to avoid the anti-dumping duty, Mainland China and Taiwan solar panel manufacturers set up plants in other Asian countries such as Malaysia and Vietnam. These countries have been exporting panels to the US and direct export from China has been dropping.

"With Trump's duty barrier in place, China won't get hit as much, as its domestic market is still growing strong.

"In addition, emerging markets such as India are likely to draw more Southeast Asian production to feed its solar capacity growth. With oversupply situation developing in the APAC region, Southeast Asian countries could also ramp up their new build projects and thus reduce reliance on the export market."

There was mixed reaction in the

stock market, with some companies saying the tariff was not as steep as they had feared. Following the announcement, shares in SunPower, a US solar developer and manufacturer that said it expected to be hit by the tariffs, were down 6 per cent.

Tom Werner, chief executive of SunPower, said he expected the company to "suffer collateral damage in a case that clearly was targeted at Chinese manufacturers". He added: "This remedy will impact SunPower more than any other solar cell manufacturer."

Shares in Sunrun, the largest independent residential solar company in the US, were up 6.1 per cent. Shares in First Solar, another US integrated group that uses a technology not covered by the tariffs, were down by 0.6 per cent.

## Cuomo throws weight behind offshore wind

The state of New York aims to become a leader in America's growing market for offshore wind and energy storage.

Siân Crampsie

The US state of New York has outlined plans to develop offshore wind energy, battery energy storage projects and reduce greenhouse gas emissions.

In his annual 'State of the State' address, NY governor Andrew M. Cuomo said that his government would issue solicitations in 2018 and 2019 to procure at least 800 MW of offshore wind energy.

The move is part of a broader plan to develop 2400 MW of offshore wind in New York, and position the state as the leading offshore wind energy market in the USA.

Cuomo also launched an initiative to deploy 1500 MW of energy storage by 2025 and employ 30 000 New Yorkers to establish the state as a home for this rapidly expanding clean tech industry.

"New Yorkers know too well the devastation caused by climate change, and in order to slow the effects of extreme weather and build our communities to be stronger and more resilient, we must make significant investments in renewable energy," Governor Cuomo said. "With this proposal, New York is taking bold action to fight climate change and protect our environment, while supporting and growing 21st century jobs in these cutting-edge renewable industries."

The plans add detail to previously announced initiatives, including New York's Reforming the Energy Vision policy, and will help to make the state

one of the most progressive in the USA in terms of clean energy development. Cuomo has also called for more aggressive caps under the Regional Greenhouse Gas Initiative (RGGI), a regional emissions trading scheme, and wants the scheme to now be applied to small peaking plants.

Currently the RGGI only applies to power plants with a capacity of 25 MW or more. Cuomo says, however, that this excludes many smaller, but highly polluting peaker units, often located close to population centres.

Under his offshore wind energy plan, Cuomo said the New York State Energy Research and Development Authority (NYSERDA) will invest \$15 million (€12.5 million) in clean energy workforce development and infrastructure advancement to train workers for jobs in the offshore wind industry. This includes offshore wind construction, installation, operation, maintenance, design and associated infrastructure.

Other initiatives announced in January include proposing a commitment of at least \$200 million from NY Green Bank for storage-related investments to help drive down costs and to strategically deploy energy storage to where the grid needs it most, and a community solar initiative for low-income households.

Cuomo has also announced more funding for energy efficiency initiatives in NY state, which has set a target of sourcing 50 per cent of its electricity from renewables by 2030.



Canadian electric utility Emera is preparing to start commercial operations of the Maritime Link, a 500 MW electricity link that includes North America's longest submarine cable.

The firm said in December 2017 that it had achieved the first energy exchange across the HVDC connector that links Newfoundland and Nova Scotia via a 170 km-long subsea cable across the Cabot Strait. Emera says the link would be ready for customers in early 2018.

Maritime Link is part of a wider regional energy development plan and will enable Nova Scotia to import hydropower from Labrador, as well as connect the island of Newfoundland

to the North American grid for the first time. It will link Nova Scotia with the Muskrat Falls generating station in Labrador, which is being developed by Nalcor Energy as part of the Lower Churchill Project.

Nexans delivered the cables for the project, while ABB provided the HVDC converter stations as well as AC substations.

The project is a key part of Canada's target of achieving a 50 per cent reduction in greenhouse emissions by 2030, and has been backed by a federal loan guarantee.

In late January, the government of Canada said it plans to invest C\$700 million (\$563 million) over the next

five years to grow its clean technology industry. The investment, to be made via Business Development Bank of Canada (BDC), will see BDC take on more risk to help high-potential clean tech firms expand by providing them with the capital they need to hire new staff, develop products, support sales, and scale up and compete globally.

The C\$700 million is part of the Canadian government's largest-ever public investment of C\$2.3 billion in clean technologies set aside in the 2017 budget.

The government also launched a call for expressions of interest for a C\$200 million programme for emerging renewable technologies.

## Brazil dominates Latin America wind energy market

Brazil is expected to continue its dominance in Latin America's wind energy market, according to MAKE Consulting.

The firm says that Latin America's wind energy market has expanded to almost 20 GW of installed capacity, with Mexico and Brazil together accounting for 80 per cent of this.

MAKE says that Brazil will dominate the market in 2018, when it expects a total of 4 GW of capacity to be added

across Latin America.

Brazil's installed wind capacity stands at around 12 GW, spread across some 470 wind farms. Last month the country's energy agency, Empresa de Pesquisa Energetica (EPE), said that around 931 wind farms totalling 26.1 GW of capacity had pre-qualified for the country's next renewable energy auction, scheduled for April.

The auction will award 20-year power purchase agreements to wind

energy projects from 2022.

It has also attracted 620 solar projects with a total capacity of 20 GW, EPE said.

■ Construction of a major new solar farm in Mexico will start early this year after developer Fotowatio Renewable Ventures reached financial close on the project. The 342 MW Potosí solar farm will play a key role in Mexico's plans to boost renewable energy capacity and reduce carbon emissions.



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## Myanmar eyes 3600 MW of additional power in four years

The Ministry of Electricity and Energy (MOEE) has pledged to provide an additional 3600 MW of electricity within the next four years.

The announcement comes after an MOEE study revealed that electricity demand is expected to reach 5774 MW by 2021-22 from 3189 MW in 2017-18. Between 2010 and 2017, demand for electricity rose by 16 per cent on average per year, the study also showed.

The target will be reached through several projects scheduled to be completed in 2018-19. Another ten power projects will be completed at various stages during the period from 2019-20 to 2021-22 to generate an additional 3117 MW.

Speaking in parliament, Deputy Minister Dr. Tun Naing said that, in addition to implementing new power projects over the next four years, the MOEE has also been upgrading existing 20-year old plants to ensure they are operating at full capacity.

Myanmar is aiming to have the country fully electrified by 2030 under its National Electrification Plan. To achieve that target, it will also begin purchasing power from its neighbours. In January the MOEE said it would sign an MoU to procure electricity from Laos.

Assistant secretary U Min Min Oo said there was an agreement in principle and that the two countries would meet soon to iron out the details before signing.

Office Head of the Lao Ministry of Energy and Mines, Daovong Phonekeo, added: "At present it's not

clear when we will start selling electricity under this programme and at what price we will sell it."

Daovong said Laos would supply electricity to Myanmar through its northern power grids.

To address the growing need for power, the government has intensified a five-year project to provide electricity to rural areas by using off-grid solutions, including solar and wind energy.

Khant Zaw, Director General at the Department of Rural Development (DRD), recently said \$90 million would be spent to implement off-grid projects between 2016 and 2021. The project aims to implement solar home systems in 8400 villages and mini-grid projects in 350 villages situated at least 16 km from the national grid.

"Nearly 100 000 households will benefit from the project that can also provide electricity to 16 000 public buildings and 40 000 streetlights. We will continue our efforts until we reach the nationwide electrification target by 2030," said Zaw.

He said more than 80 000 households in 1300 villages would have access to electricity via solar home systems and mini-grid projects to be implemented in 34 villages in the 2017-18 fiscal year.

The World Bank recently approved \$400 million in funding for Myanmar's national electrification project, \$310 million of which will go to the expansion of the national grid with the remaining \$90 million to be spent on off-grid projects.

## Japan looks offshore to cut emissions

- Bill would clarify offshore procedures
- Coal comes under fire

Syed Ali

Japan is looking to set rules to promote wind power generation as it attempts to boost renewables targets and meet its Paris climate pledge on carbon emissions.

Japan has no unified rules for offshore operations, making it difficult for entities hoping to start wind power generation to settle negotiations with stakeholders, including the shipping and fisheries industries.

The government was set to submit a bill to Parliament in late January that would clarify the required procedures. The government would first draw up a basic policy, and the industry and transport ministries would then designate areas to be promoted for wind power operations, while taking into consideration opinions from local residents.

After those steps are taken, the government will invite and select candidate operators that will use the areas for a long period.

The government hopes to reduce the cost of offshore wind power generation, currently at some ¥36000/MWh (\$330/MWh), which is about four times higher than in Europe.

A report, published by the Institute for Energy Economics and Financial Analysis (IEEFA) in March last year, showed that Japanese offshore wind resources have been largely overlooked but nevertheless have tremendous potential.

The current aims of the government are to increase the share of renewable energy to 22-24 per cent of all electricity sources by 2030.

Renewable growth is a key part of the government's efforts to meet emission targets, which have come under threat following the plan to reduce dependence on nuclear post-Fukushima.

Currently, renewable power accounts for approximately 15 per cent of total electricity generation in Japan, while hydro and solar power occupy a combined 12 per cent share, aided

by attractive government subsidies for these technologies.

Under the Paris climate change accord, countries including Japan agreed to aim for net zero greenhouse gas emissions by the end of the century. But sluggish progress on restarting nuclear plants after the 2011 Fukushima Daiichi disaster has spurred power companies to build new plants using cheaper fuels such as coal.

Japan's openness to coal, however, has met with criticism both at home and abroad.

In January Japan's environment minister said Chugoku Electric Power will need to offset emissions from a planned 1000 MW coal-fired power plant through such steps as shutting down old fossil fuel capacity. Masaharu Nakagawa said the plant in the western prefecture of Shimane could go ahead but said the utility would have to take steps to mitigate its impact, such as scrapping or suspending old, inefficient fossil fuel facilities or limiting the new plant's use.

## Chinese companies explore Australia renewable opportunities

Chinese power equipment giant Dongfang Electric Corp (DEC) is planning a move into Australia's renewable energy sector.

Last month, DEC executive Wu Zhang Wei said Australia was one of the few countries where the company did not have a presence and it was keen to explore opportunities there.

"We are contacting the developers of hydro and solar projects in Australia to see if we can supply equipment," Mr Wu said.

He said power plants using renewable sources were becoming a big part of the company's business, which has annual revenues in excess of \$A6 billion (\$4.84 billion). A decade ago, coal fired projects made up half of all the company's sales. That is now only a third, with hydro and solar contributing sizeable revenue.

DEC is the latest of a growing number of Chinese companies looking to invest in Australia. At the start of the year Goldwind Australia, an offshoot of Chinese wind turbine producer Goldwind, said that it had obtained

financing for the development of the 530 MW Stockyard Hill onshore wind farm in Western Victoria, Australia.

Renewables have been making notable progress in the country. The sector enjoyed a record year in 2017, with 50 large-scale renewable energy projects committed. This resulted in more than \$9.3 billion in investment, 4670 MW of new capacity and created more than 5400 new direct jobs in large-scale projects.

The rooftop solar PV market experienced its best ever year, with more than 1000 MW installed in 2017. This pushed rooftop solar capacity past 6000 MW, making Australia one of the world leaders in rooftop solar installations.

Meanwhile, in January RES was granted planning approval for the Murra Warra wind farm, in the State of Victoria. When completed it will be one of the largest wind farms in the southern hemisphere, with 116 state-of-the-art wind turbines providing up to 420 MW of generation capacity.

The Clean Energy Council warned,

however, that the ongoing uncertainty around long-term energy policy means that the continuation of renewables growth into 2018 and beyond is far from assured.

Chief Executive Kane Thornton said in a statement: "If the government's National Energy Guarantee (NEG) is to be successful, it will need strong support from the major state and federal political parties as well as the electricity industry. But to gain this support, it must be developed to a point where it can clearly show it is capable of delivering new clean energy investment, as well as lowering both emissions and power prices."

■ Australia is fast becoming a showcase for clean energy projects. Solar Reserve said it has been granted approval for the 150 MW Aurora Solar Energy Project in Port Augusta. Located about 300 km north of the South Australian capital Adelaide, the project will incorporate eight hours of storage or 1100 MWh. The A\$650 million project is claimed to be the largest of its kind in the world.

## Lack of regulatory action stalls Philippines power contracts

Nearly 5500 MW of contracts need immediate regulatory action amid the ongoing crisis in the Energy Regulatory Commission (ERC), said ERC chairperson Agnes Devanadera.

During a Senate energy committee hearing on January 15<sup>th</sup>, Devanadera said the regulator was unable to decide on contracts covering 5493.38 MW in supply as the minimum number of assembly members needed to make the proceedings valid were not present.

The pending contracts include 43 new certificates of commerciality (COC) equivalent to 2977.89 MW, renewal of 47 expired COCs worth 1971.49 MW, and 29 expired power supply agreements (PSAs) which cover 544 MW in supply.

The Philippine Independent Power

Producers Association Inc. (PIPPA) said there is an urgent need to address this issue on COCs, PSAs and connection agreements.

The Philippines has been making a concerted effort to ramp up its generating capacity. In January power utility Manila Electric Company (Mer-alco) said that, together with its partners, it is spending up to \$800 million on two wind farms with a combined capacity of 300 MW in Luzon.

In late December, SN Aboitiz Power Group (SNAP), the joint venture of SN Power of Norway and Aboitiz Power Corp., announced that it set to spend roughly \$1.75 billion to add another 500 MW capacity of renewable energy projects over the next decade.

## Europe News



# UK's clean strategy is not enough

■ UK pledges coal shutdown ■ 2017 marks record year for renewables

Siân Crampsie

The UK's Clean Growth Strategy must be urgently translated into action if the country is to meet emissions targets, government climate change advisors have warned.

The Committee on Climate Change (CCC) says that the Clean Growth Strategy – launched in October 2017 – needs more detail and does not go far enough for the UK to meet targets to cut greenhouse gas emissions by the 2020s and 2030s.

The warning came as environmental groups in the UK celebrated 2017 as a record-setting year for clean energy production, and an announcement by

the government confirming plans to phase-out the use of unabated coal for electricity generation by 2025.

The CCC says that the UK has made good progress in reducing its greenhouse gas emissions since the Climate Change Act was passed in 2008, nearly ten years ago. Emissions fell by 42 per cent from 1990 to 2016 – faster than the average rate of reduction in the G7.

The Clean Growth Strategy commits to delivering further action towards meeting the fourth (2023-27) and fifth (2028-32) carbon budgets, on the path to reducing UK emissions by at least 80 per cent in 2050 compared to 1990 levels.

However the CCC says that “significant gaps” remain in policy and that even if the Clean Growth Strategy is delivered in full, the UK will miss the fourth and fifth carbon budgets by around 10-65 MtCO<sub>2</sub>e.

CCC Chairman, Lord Deben, said: “The Clean Growth Strategy is ambitious in its aims to build a thriving low-carbon Britain but ambitions alone are not enough. The government's policies and proposals will need to be firmed up as a matter of urgency – and supplemented with additional measures – if the UK is to deliver on its legal commitments and secure its position as an international climate change leader.”

Environmental group WWF said that 2017 was the greenest year ever in the UK, with 13 clean energy records broken. These include the country's first full day since the Industrial Revolution with no coal power, record spikes in solar and offshore wind generation, and record low prices for offshore wind.

In the summer of 2017, almost 52 per cent of UK electricity was provided by nuclear or renewables. On one day in June 2017, wind, nuclear and solar power produced more power than gas and coal combined, the first time this has ever happened on the UK grid.

WWF says that although the UK is

successfully decarbonising, more needs to be done to ensure that investment into clean energy continues.

The CCC said in a statement that the government should “urgently” firm up policies and proposals in the Clean Growth Strategy, and develop and implement new policies to close the “emissions gap”. It should also address the risks of under-delivery.

In January, the UK government unveiled a phase-out plan for the country's eight remaining coal fired power plants. It will also set an emission limit of up to 450 g/kWh for domestic coal fired power generation facilities from October 2025 onwards, effectively forcing them to close.

## Offshore wind set for key role in Poland

Poland could build up to 8 GW of offshore wind energy capacity by 2035, according to new analysis.

The analysis is significant for a country that is heavily dependent on coal.

According to the Polish Foundation for Sustainable Energy (FNEZ), the country has “a unique opportunity” to develop offshore wind and ensure Poland's energy security. It could develop up to 4 GW by the end of 2030.

FNEZ recently established a Memorandum of the Polish Offshore Energy Sector (PPPEM), bringing together

entities from the maritime industry, offshore energy, wind energy, steel industry and manufacturers of offshore constructions, ships, and cables to underpin the development of the nascent offshore wind market in the country.

In August 2017, Polenergia became the first operator in Poland to obtain an environmental permit for the construction of an offshore wind. The project, Baltic Śródkowy III, has a planned capacity of 600 MW and will be one of the largest wind farms in the Baltic Sea.

In 2013 FNEZ estimated that Poland could accommodate up to 6 GW of offshore wind capacity. However it has revised this estimate following the development of new spatial development plans for the Polish sector of the Baltic Sea.

It says that, developed in conjunction with natural gas capacity and transnational offshore grid connections of 2-3 GW, offshore wind will help secure Poland's energy supplies in the 2025-2035 period.

FNEZ has also recognised the con-

tribution that offshore wind could make to the economy. “After 2020 offshore energy may become one of the key pillars of the Polish economy,” said Maciej Stryjecki, the President of the Management Board in FNEZ. “Polish maritime industry could provide up to 60-70 per cent share of the supply chain for OWF.”

“However, in order to use the Baltic Sea energy potential and create a competitive offshore sector in Poland it is necessary to create a stable legal and market conditions that will be

incentivise investments.”

Baltic Śródkowy III will comprise 120 wind turbines, located 23 km north of the coast. The capacity of each single turbine will be in the range of 5-8 MW, with a turbine height of around 275 m.

Construction of the wind farm is due to start in 2019 at the earliest, and it could start delivering electricity to the grid in 2021 or 2022.

A second offshore wind farm, Baltic II, is also planned, with a capacity of 600 MW.



## Statkraft exits Dudgeon

Statkraft has divested all of its interests in offshore wind farms in line with its new strategy of focusing on onshore wind, hydropower, solar energy and district heating.

The Norwegian energy producer has sold its 30 per cent stake in the Dudgeon offshore wind farm to China Resources (Holdings) Company Limited for £555 million.

It has also agreed to sell its 40 per cent share in the Sheringham Shoal offshore wind farm to the UK fund manager Equitix.

Statkraft said that it would no longer invest in offshore wind due to a limited financial capacity. The company announced in January that it would

invest NOK8 billion (€858 million) to 2023 in the upgrade and modernisation of hydropower plants in Norway and Sweden.

The company owns more than 230 hydro power plants in Norway alone, and says that the investment will ensure the plants' competitiveness.

It is also investing in the digitalisation of its power plant portfolio, according to CEO Christian Rynning-Tønnesen.

Statkraft has been operating in the UK offshore wind energy sector since 2009, when it acquired its stake in the 402 MW Sheringham Shoal project off the coast of Norfolk.

Dudgeon wind farm was developed

in cooperation with renewable energy company Masdar, which holds 35 per cent, and Norwegian oil and gas company Statoil holding the rest.

The new partner in the 402 MW Dudgeon project is a state-owned Chinese enterprise with businesses in power, consumer products, real estate, cement, gas, pharmaceuticals and finance.

■ The Norwegian government has reached an agreement with supporting parties KrF and Venstre about opening up one or two areas in Norwegian waters for floating wind farms. The plan includes establishing a full-scale pilot plant with governmental grants through Enova.

## TenneT puts its weight behind cyber security

TenneT has become the first transmission system operator to join the European Network for Cyber Security (ENCS).

ENCS collaborates with its membership to promote and boost cyber security across the European energy sector. It says that TenneT will be an important contributor to its mission because of its position in the European energy market as a multinational operator of vital transmission infrastructure.

“TenneT is very aware of its critical role in [the] daily life of people and businesses so we attach great importance to attaining a very high level of cyber resilience and security,” said Siem Bruijns, Senior Manager Corporate Safety & Security at TenneT. “Cyber threats develop rapidly, so it's essential for TenneT to have an

independent centre of knowledge to support us.”

ENCS already works with a wide variety of utilities across Europe, sharing knowledge and expertise, collaborating on research projects and conducting training. The organisation added in a statement that TenneT's membership would enable it to build on its recent memorandum of understanding with ENTSO-E.

“To keep European power grids – and consumers – safe from cyber threats, we have to collectively take security seriously at every level,” said Anjos Nijk, Managing Director, ENCS. “We have a history of strong collaboration with distribution network operators already, but our work with TenneT means we can help keep infrastructure safe at every level of the grid.”

# Turkey boosts wind capacity

■ 2017 auctions attract \$5 billion in investment ■ EBRD backs energy efficiency plans

Wind energy capacity is set to grow rapidly in Turkey following successful tenders in 2017.

A December auction for wind energy in the country resulted in transmission operator TEIAS issuing 2.11 GW in preliminary licences for 67 wind projects around the country. The auction followed one in July 2017, in which preliminary licences for 710 MW were issued, and the 1 GW so-called YEKA auction in August 2017.

The auctions mean that almost 4 GW of onshore wind energy will be developed in Turkey, requiring around \$5 billion in investments. Development of the onshore wind energy sector is a key pillar of the government's strategy to

improve energy security.

Successful bids in the latest auction ranged from \$7.29/MWh to negative bids of -\$2.87/MWh. Companies submitting negative bid prices are not eligible for Turkey's current feed-in tariff system, and have to pay TEIAS the amount of their negative bid for the first ten years of operation.

The negative bid prices submitted are a sign of falling costs in Turkey's onshore wind energy sector, according to the Turkish Wind Energy Association (TUREB).

Among the winning bidders was German firm PNE Wind, which submitted a bid of -\$2.87/MWh for its proposed Koseler wind farm, a 71 MW project

located in western Turkey's Canakkale region.

In total, 5000 MW of bids were submitted in the auction. Winning bidders are awarded a pre-licence and secure network access, and have to apply for permitting.

Data published by TUREB in December showed that the sector has garnered \$12.3 billion in investment over the past 11 years. Around eight percent of the country's electricity now comes from wind.

TUREB also says that the 1 GW YEKA contract – awarded to a consortium of Siemens Gamesa Renewable Energy (SGRE) and Turkish partners Kalyon Enerji and Turkerler Holding

– is under development. The consortium has signed contracts with the government and is in the process of designing several large-scale wind farms in three or more regions that together will constitute the YEKA project.

Another 1 GW YEKA contract – this time for solar energy – was awarded to a Hanwha-Kalyon consortium in March 2017.

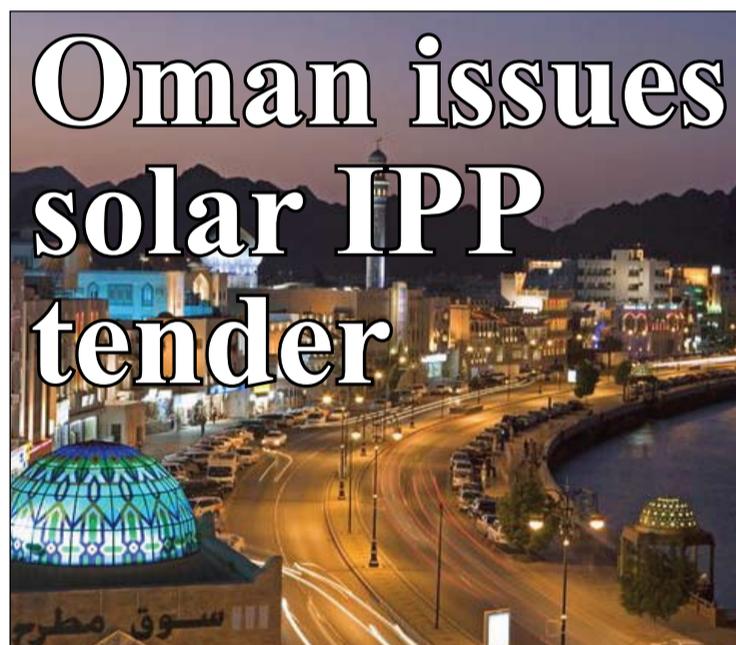
That consortium said in January that it had broken ground on a solar panel manufacturing facility in Ankara, Turkey, where panels for its YEKA project will be made.

Turkey's government has set a target of increasing the share of renewable energy resources to 30 per cent. This

will require 1000 MW of geothermal energy capacity, 20 000 MW of wind and 5000 MW of solar.

In January the European Bank for Reconstruction and Development (EBRD) gave its backing to Turkey's National Energy Efficiency Action Plan (NEAP), which aims to reduce the country's energy consumption by 14 per cent by 2023.

The plan sets out energy efficiency measures to set the country well on course to prepare for its increasing energy needs without raising its carbon emissions. It was developed with the help of the bank, and will manage \$11 billion of funds provided by the European Union.



## Oman issues solar IPP tender

■ \$20-25 billion annual investments required

■ Annual demand for hydrogen could increase ten-fold by 2050

Renewable energy is set to play a growing role in Oman's energy system, the government has said.

The country has issued a request for qualifications for its first utility-scale solar independent power project (IPP), which will add 500 MW of capacity to the grid.

The landmark project, located in Wilayat of Ibri in Al Dhahirah Governorate, marks the start of an aggressive and accelerated adoption of renewable energy technology, according to the Oman Power and Water Procurement Company (OPWP).

Oman's government has tasked OPWP with ensuring that a minimum of ten per cent of energy production comes from renewable resources by 2025. OPWP says that it aims to exceed that target with commitments for at least two projects by 2019.

The ten per cent target translates into 2500-3000 MW of capacity. OPWP is aiming to develop mainly solar energy projects, but says that wind energy capacity will also be built.

Land for future solar projects has been allocated in the wilayats of Ibri, Manah and Adam. However, the wind energy projects are expected to come up largely in the Dhofar and Wusta governorates, where wind resources are optimal.

"I am proud to announce that our first utility scale solar project will offer 500 MW of capacity, which will be one of the biggest in the region," said Eng Yaqoob Saif Hamood al Kiyumi, CEO OPWP. "This decision to start big underscores confidence in renewable energy development as well as the appetite for investment in such ventures in Oman."

The Ibri IPP will cover an 1800 MW site and will feed energy into the Oman Electricity Transmission Company's main grid. Tender documents will be issued to prequalified bidders before the end of the first quarter 2018. A formal contract award is expected to be announced in the third quarter 2018 with the Commercial Operation Date (COD) slated for early 2021.



■ Projects will benefit 2.5 million people

■ AfDB partners on off-grid energy access

The Abu Dhabi Fund for Development (ADFD) and International Renewable Energy Agency (IRENA) have given their backing to an off-grid solar energy programme that will benefit over 2.5 million people.

The two organisations say that \$25 million in concessional loans from ADFD have been awarded to two projects – one in Mauritius and another in Rwanda. The funds are being sourced from the IRENA/ADFD Project Facility, which aims to help developing countries access low-cost capital for renewable energy projects.

"For developing countries, renewable energy is a triple win: it provides a cost-effective means of providing electricity to families, fuels economic growth, and supports energy independence and security," said IRENA Director-General Adnan Z. Amin. "However, many developing countries have

trouble accessing financing for renewable energy investment.

"We are delighted that our continued partnership with ADFD will provide a stable, low-cost source of financing to help Mauritius and Rwanda achieve a sustainable energy future."

In Mauritius, the ADFD loan of \$10 million will help the Central Electricity Board install solar PV systems on rooftops of 10 000 households. The project will not only help to alleviate poverty, but also whilst contributing to the national target of achieving 35 per cent of renewable electricity in the energy mix by 2025.

In Rwanda, the ADFD loan of \$15 million will contribute to the installation of 500 000 off-grid solar PV home systems across the country, providing clean electricity for lighting, mobile phone and radio charging. The project is a major part of the government's

rural electrification strategy and is one of the most affordable payment schemes in Africa.

The loans cover up to 50 per cent of project costs, leveraging additional funding from other sources. Since 2014, ADFD has allocated \$214 million to 21 projects, attracting over \$420 million in additional co-financing from governments and development funds.

Separately, the African Development Bank (AfDB) has formed partnerships with Calvert Impact Capital (CIC), Global Environment Facility (GEF) and the Nordic Development Fund (NDF) to drive investments in off-grid energy across Africa.

Through the partnership, the AfDB approved a \$30 million investment in the Facility for Energy Inclusion Off-Grid Energy Access Fund (FEI OGEF).

## Russia commissions first wind farm

Russia has commissioned its first commercial scale wind farm, according to developer Fortum.

The 35 MW Ulyanovsk wind farm is located almost 700 km southeast of Moscow and is equipped with turbines supplied by China's Dongfang. It is the first of 26 projects totalling

1 GW of capacity that Fortum will build in the country with its partner, Rusnano.

Ulyanovsk is included in the renewable projects competitive selection administered by the government's ministry of energy, and so is entitled to capacity supply agreement (CSA)

payments.

Under the CSA, Fortum receives payments of €180-200/MWh for a guaranteed period of 15 years.

Fortum and Rusnano won 1 GW of capacity at an auction held in Russia in June. The two companies say they will commission the sites by 2022.

# TOSHIBA

## Brookfield secures Westinghouse future

Brookfield Business Partners says it hopes to leverage Westinghouse's strong global market position and diversified customer base after sealing a deal to buy the nuclear firm from Toshiba.

Brookfield, a business and industrial company, signed an agreement with Toshiba in early January to buy Westinghouse for \$4.6 billion.

The deal should bring an end to the financial woes that brought Westinghouse to bankruptcy in 2017.

Brookfield says it will fund the acquisition with approximately \$1 billion of equity, approximately \$3 billion of

long-term debt financing and the balance by the assumption of certain pension, environmental and other operating obligations.

"Westinghouse is a high-quality business that has established itself as a leader in its field, with a long-term customer base and a reputation for innovation," said Cyrus Madon, CEO of Brookfield Business Partners. "We look forward to bringing our significant expertise and reputation as a long-term owner and operator of critical infrastructure in the US and globally, as well as our deep facilities

management capabilities, to enhance the company's position as a leading global infrastructure services provider to the power generation industry."

Westinghouse's bankruptcy was caused by long delays and cost overruns at two US nuclear power plant projects. Its position as the largest service provider to the world's nuclear power facilities, its expertise and ability for technology innovation are among the company's strengths, Brookfield says.

"Brookfield's acquisition of Westinghouse reaffirms our position as the

leader of the global nuclear industry," said Westinghouse President & CEO José Emeterio Gutiérrez. "Our transformation and strategic restructuring process is creating a stronger, stable, and more streamlined global Westinghouse business, for the benefit of our customers and employees."

Brookfield's acquisition of Westinghouse is expected to close in the third quarter of 2018, subject to bankruptcy court approval and regulatory approvals. Throughout the process, Westinghouse will continue to operate in the ordinary course of business under its

existing senior management, the firm says.

In January, South Carolina-based Scana, the company leading development of the VC Summer nuclear power plant project, accepted a \$14.6 billion takeover deal from Dominion Energy.

Scana scrapped the VC Summer nuclear project in July 2017 after Westinghouse declared bankruptcy.

A second Westinghouse nuclear project in the USA – Vogtle Units 3 & 4 – has been given regulatory approval to go ahead.

## Shell buys UK utility firm

Shell has signed a deal to purchase UK energy provider First Utility in a move designed to boost the oil giant's green credentials.

The company will buy 100 per cent of First Utility, which provides 825,000 homes in the UK with energy and broadband services, and says that the move will enable it to "enter a new part of the energy market".

Shell's CEO Ben van Beurden announced in late 2017 that the company intended to ramp up investment in new energy businesses towards \$2 billion annually.

The strategy is designed to reduce the company's carbon emissions and boost its presence in new and innovative energy markets. It says that its European gas and power marketing and trading business will continue to supply wholesale gas and electricity to energy retailers in the UK and

Europe, including First Utility.

In 2015, a licensing agreement between Shell Brands International and First Utility enabled them to operate in the German household energy sector under the Shell brand.

"We believe that the time is right to build upon our strong relationship with First Utility by investing to grow its business," said Mark Gainsborough, Shell's Executive Vice President of New Energies.

"The supply and demand of residential energy is rapidly changing, driven by new technologies that enable householders to better manage their energy use, and the need for a low-carbon energy system," said Gainsborough. "This combination will enable Shell to enter a new part of the energy market in the UK and to improve choice for customers by delivering innovative services at competitive prices."

## AES and Siemens launch Fluence battery business

AES and Siemens have started their collaboration in the battery energy storage business by launching Fluence, their new joint venture.

The two companies say that Fluence will now embark on an "aggressive" expansion strategy in the global energy storage market, backed by the financial support of the two parent organisations.

It will supply the hardware for the world's largest lithium-ion battery-based storage project, a 100 MW/400 MWh (4-hr duration) installation in Long Beach, California, USA, and

has also announced plans to supply India's first grid-scale storage system, a 10 MW installation for Tata Power-DDL.

Fluence will combine the engineering, product development, implementation and services capabilities of AES Energy Storage with Siemens' energy storage team.

It will also use Siemens' global sales force to market and sell Fluence energy storage systems, including Siestorage, Advancion, and the newest Fluence platform, SunFlex Energy Storage for solar PV.

## Areva resurrects Framatome name

- EDF, MHI and Assystem complete share deals
- Framatome expands I&C business

Siân Crampsie

Framatome says that it will seek new opportunities in the global nuclear energy market as it embarks on a new phase in its history.

Areva announced last month that it had renamed its New NP subsidiary Framatome and that it had completed deals with EDF, Mitsubishi Heavy Industries (MHI) and Assystem to sell its shares in the company.

Framatome has also announced plans to expand its instrumentation and control (I&C) business through the acquisition of Schneider Electric's nuclear automation business.

It has also signed a deal with China's CNNC for the development of a global strategic cooperation.

Areva and EDF announced in December 2017 that they had signed a definitive agreement for the sale of New NP, with EDF acquiring 75.5 per cent of the company. Assystem has purchased a five per cent stake, and MHI 19.5 per cent.

Framatome says that it will have an internationally focused strategy of development and industrial excellence, building on its existing global fleet of 440 reactors in 31 countries, as well as new capacity under development.

It also says that its recent asset sales agreement with Schneider Electric would support its business operations and future plans. More than 80 safety I&C systems have been installed by

Framatome on 44 reactors in 17 countries across the world, and approximately 250 automation systems have been installed or are being installed by Schneider Electric.

"This is an exciting time of growth for our company, and the acquisition and partnership with Schneider Electric build on our long history of providing nuclear operators with both digital and analogue I&C solutions," said Gary Mignogna, President and CEO of Framatome Inc. "With this acquisition, we will provide long-term support for our customers' systems and serve as the original equipment manufacturer for their I&C upgrades and modernisations."

Under its deal with CNNC, the two companies will extend their cooperation in nuclear fuel design, engineering and services; enhance their collaboration on digital instrumentation and control for nuclear power plants; and increase their cooperation in maintenance, safety and operation upgrades for in-service nuclear power plants.

MHI said in a statement that its shareholding in Framatome would establish a framework for cooperation between MHI, Framatome and EDF, and also support the sale of the AT-MEA1 reactor.

MHI's investment will also result in the restructuring of ATMEA, which was formed as a joint venture between MHI and Areva NP.

Under the new structure, MHI and EDF will own equal 50-50 shares in

ATMEA, with a special share held by Framatome.

New NP was established under a restructuring of Areva NP and comprises the French firm's nuclear power plant equipment and systems manufacturing business. EDF agreed to buy a majority stake in the company in 2015 as part of the restructuring and plans by the French government to rescue Areva with a €4.5 billion injection.

Framatome has 14,000 employees worldwide and holds around 3,500 patents covering some 680 inventions. "Framatome possesses unique know-how in an industry that today is and will remain key for a low-carbon energy mix," said Bernard Fontana, Chairman of the Managing Board and Chief Executive Officer of Framatome. "As we emerge from this transition phase, I share their pride and I want to thank them for all the work they have accomplished."

He added: "Steeped in a rich heritage, Framatome is today one of the reference players in the nuclear sector worldwide, benefiting from unparalleled operating feedback. Our ambition is delivering a level of industrial excellence that is recognised by our customers."

■ New Areva has now become Orano. Refocused on nuclear materials development and waste management, Orano's activities encompass mining, conversion-enrichment, used fuel recycling, nuclear logistics, dismantling and engineering.

## 10 | Tenders, Bids & Contracts

### Americas

#### PSEG signs up for R-R services

Rolls-Royce has signed a four-year contract to provide US nuclear utility operator, PSEG, with its innovative digital analytics service to help drive greater plant efficiency.

The four-year contract involves the deployment of Rolls-Royce's T-104 service at PSEG's two nuclear power plants in New Jersey, USA – Salem and Hope Creek. It follows a successful six-month pilot scheme which showed 40 per cent of planned maintenance activities that were included in the trial, did not need to be conducted as regularly as scheduled.

The T-104 service uses worldwide nuclear power plant operating data to provide asset management services. Rolls-Royce converts that intelligence into insights to enable PSEG to maximise plant availability and reliability by allowing it to focus on the right equipment, at the right time, with the necessary parts at hand.

#### Vestas seals Aluar expansion deal

Vestas has signed a deal with Aluar Aluminio Argentino S.A.I.C to extend the Aluar wind park in Argentina.

Earlier this year, Aluar, the only aluminium smelter in Argentina, placed a 50 MW order for the first phase of the El Llano wind park. The latest order will bring the capacity of the wind farm to 100 MW.

The contract to build the wind park's second phase comprises supply and installation of 14 Vestas V126-3.45 MW turbines delivered in 3.6 MW Power Optimised Mode, as well as a 15-year Active Output Management 5000 (AOM 5000) service agreement, ensuring optimal operation of the wind park.

#### SGRE wins 330 MW of wind orders in USA

Siemens Gamesa Renewable Energy (SGRE) has signed two orders in the USA for the supply of 95 of its G132-3.465 MW wind turbines.

SGRE will supply 47 turbines for the Midway wind project, located in San Patricio County, Texas. The project was awarded by Apex Clean Energy and recently acquired by Sammons Renewable Energy.

The second project with an undisclosed customer will feature 48 machines and is scheduled for commissioning in 2019. This project represents the first US order for this specific turbine.

#### GE lands Norte III O&M deal

GE's Power Services business has signed long term agreements with a consortium formed by Macquarie Capital and Techint covering the 907 MW Norte III gas fired combined cycle power plant in Mexico.

The \$330 million deal includes two fully integrated, multi-year contracts, including an Operation and Maintenance (O&M) agreement and a Contractual Service Agreement (CSA).

Under the terms of the 25-year agreement, GE will utilise its Fleet360 platform of total plant solutions for the Norte III plant, which operates on four of GE's 7F.04 gas turbines as well as two Toshiba steam turbines.

The combined cycle power plant is located south of Ciudad Juarez in the State of Chihuahua, Mexico.

#### Wind turbines ordered for Vicente Guerrero project

Vestas has secured an order from Mexican firm Compania Eolica Vicente Guerrero to deliver wind turbines totalling 118 MW for the Vicente Guerrero wind park in Tamaulipas, Mexico.

Vestas will supply and erect 27 units of its V136-3.45 MW wind turbines delivered in 3.6 MW Power Optimised Mode and 6 units of V136-3.45 MW. The deal also includes a 20-year Active Output Management service agreement (AOM 4000).

Turbine supply is anticipated to start in 3Q 2018 with commissioning set in 1Q 2019.

### Asia-Pacific

#### Siemens Gamesa boosts India business

Siemens Gamesa Renewable Energy (SGRE) has won a total of 326 MW of orders for wind energy in India.

The company says it has won multiple orders from several independent power producers and industrial customers for projects around the country. Under the agreements, SGRE will handle the entire infrastructure needed to operate the projects together with the supply, erection and commissioning of 135 units of G114-2.0 MW wind turbines and 28 units of its G97-2.0 MW.

The wind turbines will be used across 26 separate sites ranging from 2 MW to 60 MW in size. They will be commissioned by March 2018.

#### Vestas secures Ostro Kutch order

Vestas has secured a deal from Ostro Kutch Power for turbines totalling 250 MW for a wind farm in Gujarat, India.

Vestas will deliver, install and commission 125 of its V110-2.0MW turbines, as well as carry out the project's civil and electrical works.

The project, sited in the Kutch district, would be commissioned by the third quarter of 2018.

Vestas will also service the hardware under a 10-year full-scope active output management 4000 deal and a Vestas Online Business SCADA solution.

#### BHEL to expand 660 MW Bhusawal project

India's BHEL has secured an order worth \$438 million for the expansion of the Bhusawal coal fired power station in Maharashtra state, India.

BHEL's scope of work includes the design, engineering, manufacture, supply, construction, erection, testing and commissioning of a single 660 MW supercritical coal fired unit and civil works.

The existing 1420 MW Bhusawal power plant, in Jalgaon, consists of four thermal units and is owned by Maharashtra State Power Generation Company.

#### GE wins Theparak deal

GE Renewable Energy has won an order to provide 270 MW of wind turbines to Wind Energy Holding for the Theparak wind farm in central Thailand.

GE will provide 90 of its 3.0-137 wind turbines with 156.5 m hybrid towers, making them the tallest turbines it has ever installed outside of Europe. "Our 3.0-137 wind turbine

with its 156.5 m tower is ideal for the very specific wind conditions in central Thailand and has the potential to contribute to reaching grid parity for onshore wind in the country," said Pete McCabe, President and CEO of GE Onshore Wind.

GE will supply the wind turbines' electric drive train with generators and pitch motors and will also supply the collector and grid interconnection substation packages, including high voltage switchgears, transformers, SCADA controls, telecommunications and power systems studies for the wind farm. The 270 MW of capacity will be installed in three phases of 90 MW and is scheduled to begin commercial operations in 2018.

#### China selects SGRE turbines

Siemens Gamesa Renewable Energy (SGRE) has signed two new agreements for the supply of 96 MW for wind farms in China.

SGRE will supply 48 MW to Chinese utility Datang and another 48 MW to the Chinese General Nuclear Power Group.

Under the terms of the contract with Datang, SGRE will supply and commission 24 of its G114-2.0 MW turbines at the Yangshugou wind farm located in the province of Liaoning, in northeastern China.

The agreement reached with CGN encompasses the installation of 24 of the firm's G97-2.0 MW turbines at the Wohushan wind farm located in the province of Shandong, eastern China.

The turbines for both projects will be delivered in 2018.

#### Voith signs Henan Tianchi pumped storage contract

Henan Tianchi Pumped Storage Co. Ltd. and Voith Hydro Shanghai Co. Ltd. have signed a contract for the supply of equipment for the Henan Tianchi pumped storage hydropower plant in China.

Under the agreement, Voith will supply four 300 MW Francis reversible pump turbines and generators as well as auxiliary equipment. The power plant will have a total installed capacity 1200 MW and a rated head of 510 m.

Under the contract, the first unit will be put into operation by the end of September 2021, and the last unit will commence commercial operation in June 2022.

#### Pöyry is owner's engineer for Kedah PV contract

Leader Solar Energy Sdn Bhd has awarded Pöyry an owner's engineer services assignment for a 29 MW solar photovoltaic (PV) power plant project in Kedah, Malaysia.

Pöyry has already completed conceptual design, preparation of technical specifications, assistance in selecting the EPC contractor and assistance in EPC contract negotiations for this project. It says it will continue to support the project by providing assistance in project management, design review, and site supervision services.

The overall schedule for Pöyry's services during the project execution is eight months.

### Europe

#### GE wins Paks turbine deal

GE Hungary is to build the turbines for Hungary's Paks 2 nuclear power plant.

GE Hungary won the competitive bidding process for the \$1 billion contract, Russian state-run news agency *Ria Novosti* reported last month.

Paks 2 nuclear power plant, located 100 km south of Budapest, will be powered by two VVER-1200 and have a capacity of 2400 MW. Construction works for the reactor will start in 2018 and the plant is expected to be operational by 2026.

#### Falck buys Nordex hardware

Falck Renewables has awarded the Nordex Group two contracts to supply a total of 31 of its N131/3900 wind turbines and the associated civil and electrical infrastructure to two wind farms in Sweden.

Preliminary works on the Aliden and Brattmyrliden wind farms have already started and construction is due to intensify at the sites in 2018 and 2019, respectively. The turbines have been specifically designed for local site conditions, with a maximum rated capacity of 3.9 MW each, 134 m towers and NR65.5 blades.

#### Enel deploys predictive maintenance

GE is to provide the global thermal generation division of Enel with its Predix predictive maintenance software solution at 14 of its thermal power plants in Europe and Latin America.

Enel will deploy the GE Asset Performance Management (APM) software at 13 gas-fired and one coal fired power plant to monitor, predict and enhance the facilities' reliability. All the power plants use GE or Alstom technologies, and together have a combined capacity of 7 GW.

#### HOFOR selects enTrader

Danish utility HOFOR has selected Contigo's enTrader to manage its Nordic power trading activities.

Contigo's enTrader product is a full end-to-end ETRM solution, delivering automated trade capture, position management, risk management, credit management and regulatory reporting capabilities.

It will provide HOFOR with the ability to seamlessly integrate between its trading systems and other critical business systems, reducing operational risk and removing manual processes.

HOFOR identified a need to replace its existing in-house trading system because of growing complexity and changing regulations within the Nordic energy market.

### International

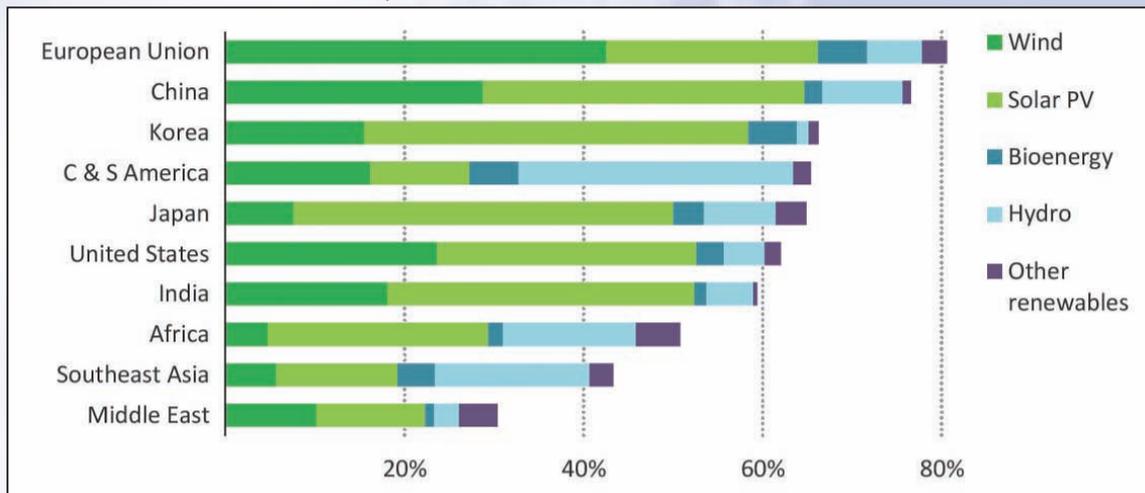
#### BWSC wins turnkey contact for Benin

The Danish power plant specialist Burmeister & Wain Scandinavian Contractor A/S (BWSC), in consortium with MAN Diesel and Turbo (MDT), has been awarded a €125 million contract to build a 120 MW power plant in Benin.

The project is a complete turnkey power plant project, which entails construction of a whole new power house for seven MDT dual fuel engines and all corresponding infrastructure. The dual fuel heavy fuel oil (HFO) and gas fired power plant will be located at the Maria Gléta site, about 15 km from the city of Cotonou.



Share of renewables in total capacity additions by region in the New Policies Scenario, 2017-2040



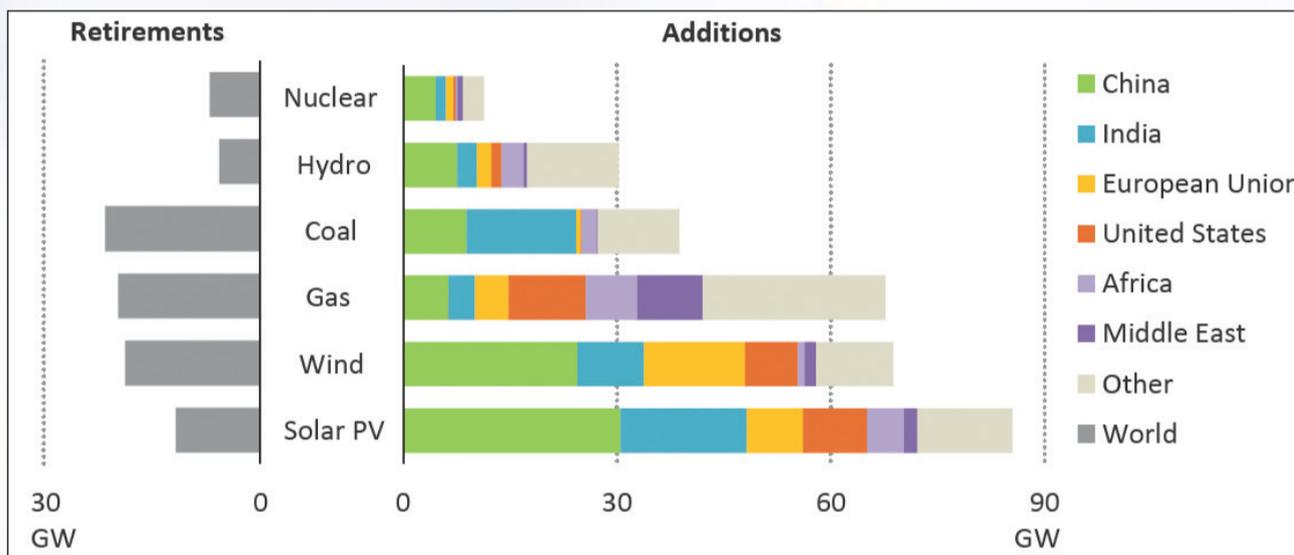
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World Energy Outlook 2017, © IEA/OECD, Figure 6.7, page 245

Global average annual capacity additions and retirements by technology in the New Policies Scenario, 2017-2040



World Energy Outlook 2017, © IEA/OECD, Figure 6.8, page 246

Cumulative power plant capacity retirements by region and source in the New Policies Scenario, 2017-2040 (GW)

	2017-2025						2026-2040						2017-2040 Total
	Coal	Gas	Oil	Nuclear	Renewables	Total	Coal	Gas	Oil	Nuclear	Renewables	Total	
North America	64	57	52	14	22	210	29	91	16	12	167	315	524
United States	58	51	43	11	17	180	22	88	8	12	140	270	450
Central & South America	1	5	9	0	4	19	3	8	10	1	28	50	70
Brazil	0	1	1	-	3	5	1	0	1	1	17	20	25
Europe	67	14	31	27	39	179	101	47	18	56	292	514	693
European Union	45	7	26	26	34	137	83	40	15	43	272	454	591
Africa	8	3	11	-	2	23	25	15	10	2	9	61	84
South Africa	8	-	1	-	0	8	24	0	0	2	3	29	37
Middle East	0	11	12	-	0	23	0	31	27	-	1	59	83
Eurasia	25	55	4	8	0	93	30	46	5	12	4	97	189
Russia	21	47	2	8	0	78	22	41	2	12	3	80	158
Asia Pacific	49	26	32	20	17	144	115	64	59	16	364	618	762
China	25	0	1	-	4	30	46	1	3	-	236	287	317
India	7	0	0	0	2	10	34	7	9	1	43	94	104
Japan	7	17	20	10	5	59	10	22	19	5	47	104	162
Southeast Asia	0	2	5	-	3	10	5	18	16	-	12	51	61
<b>World</b>	<b>215</b>	<b>172</b>	<b>151</b>	<b>70</b>	<b>84</b>	<b>692</b>	<b>302</b>	<b>302</b>	<b>144</b>	<b>100</b>	<b>866</b>	<b>1 714</b>	<b>2 405</b>

World Energy Outlook 2017, © IEA/OECD, Table 6.3, page 248

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## Oil

# Crude oil prices on the rise, but US production could stem the trend

- Non-Opec supply to increase by 1.7 million b/d
- Opec to maintain production cuts through 2018

David Gregory

Oil market analysts in late January were questioning how much longer the bullish oil market would continue as prices neared the \$70/b point, and again, for the first time in a long time, the role of speculators in the oil market came into play.

After a year of restricting oil production, Opec and its non-Opec partners have managed to see some gain in oil prices. But whether that is due to their efforts to eliminate excess supply of crude or whether oil prices are being driven by an improving global economy or rising demand or a combination of many things, the real question is whether the price increase is sustainable. Analysts suggest that rising prices could encourage US shale oil to rush the market – the factor that had convinced Saudi Arabia in 2014 to increase production in an attempt to force high-cost producers like shale out of the market.

The Saudi strategy did not work and

the oil industry has been struggling with the consequences since. But over the last three years, the oil industry has adjusted itself to new circumstances, cut a great many costs, trimmed itself down and now is beginning to talk about new projects and investments. As does everything, the market and circumstances evolve.

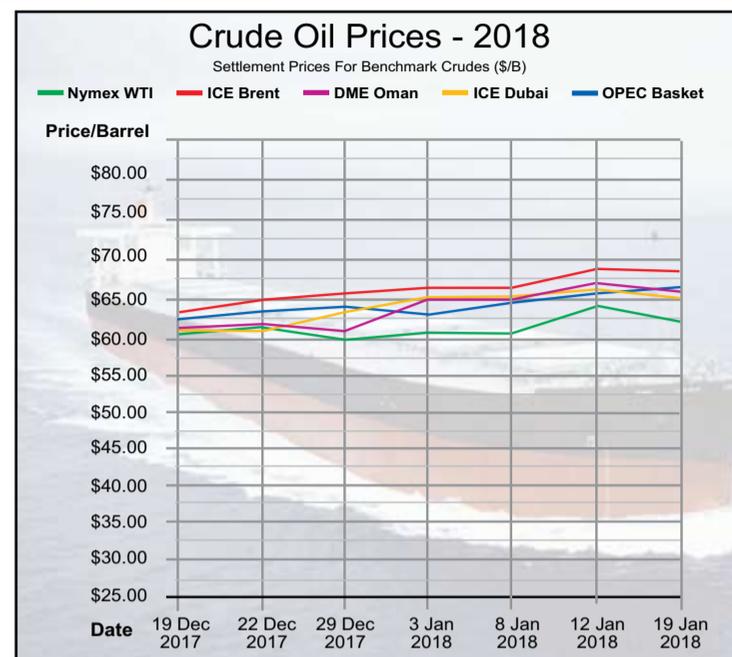
In its January *Oil Market Report*, the Paris-based International Energy Agency (IEA) said its demand estimates for 2017 and 2018 remained almost unchanged at 97.8 million b/d and 99.1 million b/d, respectively. It estimated demand growth in 2017 at 1.6 million b/d compared to 1.3 million b/d and attributed the slowdown in demand growth this year to the impact of higher prices, the changing patterns of oil use in China, weakness in demand in OECD countries, and the switch to natural gas.

But the IEA added that rapid growth in US production and increased output in Canada and Brazil would increase non-Opec supply by 1.7 million b/d,

which is more than enough to cover the increase in demand. US crude oil production would rise above 10 million b/d it said, overtaking Saudi Arabia and challenging Russia and the world's largest producer. For that reason, Opec leader Saudi Arabia is not ready to express confidence that the market is on its way to correction.

At the Opec Ministers' Monitoring Committee in Oman in late January, those participating in the production cuts agreed to maintain them throughout 2018 and possibly continue them into 2019.

"We need to see the confidence level of investors within the companies and financial community improving about the long-term prospects of the market, and that is why my guidance to my colleagues is that we should not limit our efforts to 2018," Saudi Energy Minister Khalid al-Falih said after the meeting. Russia has voiced its support for continuing to monitor and manage the oil market for the time being.



The oil market is tightening, the IEA said, noting that during the second, third and fourth quarters of 2017, OECD crude stocks declined by an average of 630 000 b/d, which in previous such scenarios brought about a rise in prices. But the agency questioned whether Brent crude would stick to a \$60/b-\$70/b range in 2018. Citing the political and economic problems looming in Opec member Venezuela, other geopolitical uncertainties and the dynamics of the US oil shale industry, the IEA predicted another volatile year.

For its part, the US Energy Information Administration (EIA) in its latest monthly report did not predict that the current high prices would continue into next year. It put Brent at an average of \$54/b in 2017 and forecast prices of \$60/b and \$61/b, respectively, in 2018 and 2019. West Texas Intermediate (WTI), the EIA said,

would average a price of \$56/b in 2018 and \$57/b in 2019.

It said Opec production declined by 0.2 million b/d during 2017 to average 32.5 million b/d as a result of the November 2016 agreement amongst most Opec producers and its non-Opec allies to limit production. It forecast that Opec production would increase by 0.2 million b/d in 2018 and by 0.3 million b/d in 2019 "as crude oil production slowly returns to pre-agreement levels".

Regarding US production, the EIA forecast an average of 10.3 million b/d in 2018, an increase of 1 million b/d over 2017. The administration said that if this level is achieved, it would be the highest annual average on record for the US, surpassing the previous record of 9.6 million b/d set in 1970. US crude oil production in 2019 is forecast to rise to an average of 10.8 million b/d.

## Gas

# Azerbaijan's Socar to examine closer gas ties with Bulgaria

Azerbaijan plans to examine a proposal that would help it find more markets and distribution routes in Europe for its natural gas. The proposal would also enable Bulgaria to create a natural gas hub in southeastern Europe.

Mark Goetz

The State Oil Company of the Azerbaijan Republic (Socar) will examine the possibilities of investing in Bulgaria's natural gas system, it was announced in Baku last month during a meeting between Azeri President Ilham Aliyev and Bulgarian Prime Minister Boyko Borisov.

Bulgaria is keen to move forward its plans to create a natural gas hub in southeastern Europe and expand its domestic grid. Socar is keen to find more markets and distribution routes in Europe for its natural gas. Both countries are involved in gas pipeline projects that comprise the Southern Gas Corridor, which is scheduled to begin transporting Azerbaijan's Shah Deniz Stage 2 (SD2) gas to Europe by 2020.

The bulk of the Azeri gas will be piped into Europe through the Trans Adriatic Pipeline (TAP) after it arrives through the South Caucasus Pipeline (SCP) and

the Trans Anatolian Natural Gas Pipeline (TANAP). Bulgaria will receive 1 billion cubic metres (bcm) annually of Azeri gas through the Interconnector-Greece-Bulgaria (IGB), which will connect with TAP in northeastern Greece. The IGB, with a 3-5 bcm/year transport capacity, is expected to begin construction this year.

Bulgaria's current gas demand is some 3 bcm/year, practically all of which is supplied by Russia, but Bulgaria's gas mix could change in coming years once the IGB comes into operation and the European Union's plan to better interconnect the gas grids of all its members begins to solidify.

Gas will be arriving in Bulgaria from Azerbaijan, but possibly also from Greece, which plans to install a floating storage and regasification unit (FSRU) at Alexandroupolis in the northern Aegean where natural gas in the form of LNG might be delivered from the US and perhaps eventually the East Mediterranean

with the intention of supplying East Europe.

Last summer Bulgaria approached Russia with the idea of assisting with the construction and supply of its Balkan Gas Hub, but there has been no commitment. Not everyone is convinced that Bulgaria's Black Sea port of Varna is ideally suited for a hub.

Socar, however, is willing to look at the gas hub proposal. Last summer it signed a memorandum of understanding with Bulgaria that called for studying the options for additional routes to supply and transport Azeri gas. The MOU said Socar was prepared to study the technical and the trade capabilities of the gas network of Bulgartransgaz (the Bulgarian state-owned gas transport company) to transport additional volumes of natural gas through Bulgaria to other European markets.

In Baku, President Aliyev recently said Socar would soon begin the studies. "Taking into account that in a few years one billion cubic metres of

Azerbaijani gas will be transported to Bulgaria, today together with Mr. Prime Minister [Borissov] we instructed the heads of relevant structures for Azerbaijan's state oil company Socar to rapidly study the options of gas supply in Bulgaria and present the possible opportunities," he said.

Stage 2 development of Azerbaijan's offshore Shah Deniz gas field will bring another 16 bcm/year into production on top of the 8 bcm/year capacity the field has now. Of the 16 bcm/year, only 10 bcm/year will be arriving at the Turkey-Greek border and transported further into Europe. But Azerbaijan's gas reserves are estimated at 2.6 trillion cubic metres, a huge amount that could supply European markets for a very long time.

To this end, Socar has been keen to widen its distribution in southeast Europe, where countries want to reduce their dependence on Russian supplies even though Russia will be a top supplier for many years to come. Socar

holds a 20 per cent stake in the TAP pipeline, 58 per cent of TANAP, and 17.6 per cent in the SCP. In 2016 it negotiated for a major shareholding in Greece's gas transport company Defsa, but that deal fell through last year.

The Greek gas company Depa and Italy's Edison continue to pursue the idea of an Interconnector-Greece-Italy (IGI) pipeline. This Greek-Italian joint venture is a 50 per cent partner in the IGB pipeline in the form of IGI Poseidon. Currently their focus is on completing the IGB, but they are also pushing the EastMed Pipeline, which would carry gas produced in the East Mediterranean from Cyprus to Crete to Greece to Italy via a subsea pipeline – 2025 is the target date for start-up.

But IGI Poseidon is reported to remain keen on the idea to transport Azeri gas across northern Greece to southern Italy as it proposed a decade ago when the Southern Gas Corridor concept was just taking shape.

# Taking charge?

Electricity infrastructure developments are already being seen in some markets to accommodate electric vehicles. However, a huge amount of work remains to be done to avoid making generating capacity and grid investments in the shorter term that become unnecessary in the long-term.

**Matt Brown**

In a future where 50 per cent of all cars, buses and motorcycles are 'all electric' across the EU28, the annual electricity demand would be 330 TWh higher.

To some this may not seem much but it is equivalent to adding a country the size of Italy to the electricity demand of the EU28. If the 330 TWh was considered on a standalone basis, it would require 45 GW of base-load plant which is equivalent to 14 Hinkley Point Cs. But what does it mean for investment needs when considered in the existing electricity system and what impact will it have on the generation and distribution of electricity?

With spare capacity on the current system, additional energy demand could in theory be accommodated without the need for new capacity.

We use Great Britain (GB) to demonstrate this. In GB, peak demand currently occurs in the winter at around 18:00 (see Figure 1). Imagine all cars slow charge at the same time overnight in a seven-hour period starting at 23:00. In this example, it would be possible to accommodate over 21 GW of charging demand before a new peak demand period is created. However, if charging starts when people return home from work, at 18:00, then the impact is direct and new capacity is required immediately. Assuming a 50 per cent penetration of EVs in GB, the demand from charging over these seven hours translates to 20 GW and so can in theory be accommodated within the existing generating capacity.

However, the situation both today and in the future is not well represented by this characterisation for a number of reasons, not least:

- the continuing increase in non-dispatchable generation such as solar and wind; and
- the growing potential of flexible demand from appliances and EVs, to balance supply and demand in a smart, digitalised, decentralised energy system.

As the amount of wind and solar grows in the electricity system, the shape of electricity demand will no longer be the main driver for when to charge an EV, as low electricity prices will not necessarily coincide with periods of low demand overnight. Rather than charging overnight, it will make sense for EVs to charge during a sunny or windy period. Assuming that the average EV

user charges once a week, then as shown in Figure 2 the best day to charge in Germany during week 45 2017 is November 11<sup>th</sup>.

The price of electrical energy on, say, a 15-minute dynamic basis, can provide the right signal about when best to charge an EV. Consumers will, if so enabled by technology in the future, set their preferences and the EV will do the rest. Such preferences may be that they never want less than 40 per cent charge in their EV and are willing to pay a maximum amount per day for their electricity.

The pricing of electricity will also need to be dynamic so that as demand increases, prices respond and additional demand sees its impact on price levels. For this to work, of course, consumers will need smart meters that can record demand on this 15-minute basis and retail prices that reflect the changing value of electricity in each 15-minute period.

A key question is: can EVs solve the grid problems they cause? It is a matter of distribution and diversity.

In practice, our electricity systems rely on diversity of demand to hold down costs. The fact that people use electricity at different times means that the capacity of the system is lower than it would need to be if they used it at the same time.

With non-smart systems it doesn't matter to the residential consumer when their electricity demand occurs as settlements are based on half-hourly or hourly profiles rather than on actual demand. But in a world in which flexible demand is chasing low electricity prices, there is an incentive for consumers to charge their vehicles at the same time. Natural diversity will reduce and distribution systems will need even greater levels of investment. The cost of distributing electricity will be low most of the time and then increase significantly when grid capacity grows scarce. There will exist at times a tension between the cost of electrical energy and the cost of distribution. The cost of delivered electricity will vary significantly with time and location.

The impact that this has on the electricity system will depend on the underlying characteristics of the system. In systems with high levels of hydro storage, the variation in electricity prices driven by wind and solar will be low. The incentive to all charge at the same time will be re-



**Brown: The impact on the electricity system will depend on the underlying characteristics of the system**

duced. In systems built to cope with mainly electric heating, home-based slow-charging demand is proportionally less important as the distribution system is already built for larger loads (as long as one avoids having the heating on at the same time as the EV is charging).

One solution is a system of dynamic pricing that reflects the cost of electricity at a specific location. The pricing option could be a variation on nodal pricing, common in many electricity markets, but which is extended down to the local distribution level, even to a price at the top of a city street. Whatever the form, the key will be reflecting the cost of electrical energy and the cost of distributing electricity to an appropriate degree of temporal and geographical resolution.

Unless customers see the cost of their actions through locational dynamic pricing of electricity, it is likely that very significant investments in electricity distribution infrastructure will be made unnecessarily. In the interim, a system of pricing distribution use on a kW capacity rather than kWh energy basis to reduce individual consumer peaks may alleviate the issue. Some trials of command and control by distribution companies, in which the distribution company controls the charging time, have taken place but it is difficult to see how this is consistent with a smart energy future.

Another key question that remains

with EVs is their ability to inject energy back into the grid economically. With current technology, the received wisdom is that cycling of the EV battery has too great a cost, but battery technology will no doubt improve over time and, if re-injecting from an EV creates a value that can be captured, then developments will likely lead to a lower cost.

The economics of EVs reinjecting electricity into the system could end up being based on the cost of storing energy in, and re-injecting energy from, an EV (or static) battery versus the cost of grid reinforcement. So when you want to charge your EV at a specific time and there is local grid congestion, you will charge from other EVs that are discharging energy in your local street or area.

The available re-injection capacity from EV batteries will be limited by the connection to the grid and by the ability of the grid to distribute electrical energy. An EV battery can deliver a large amount of power to the motor by comparison to its grid connection. But even with this limit, the GW of capacity that could be delivered by a 50 per cent penetration of docked EVs is large and this could lead the way to an electricity system premised on renewables and EV battery storage.

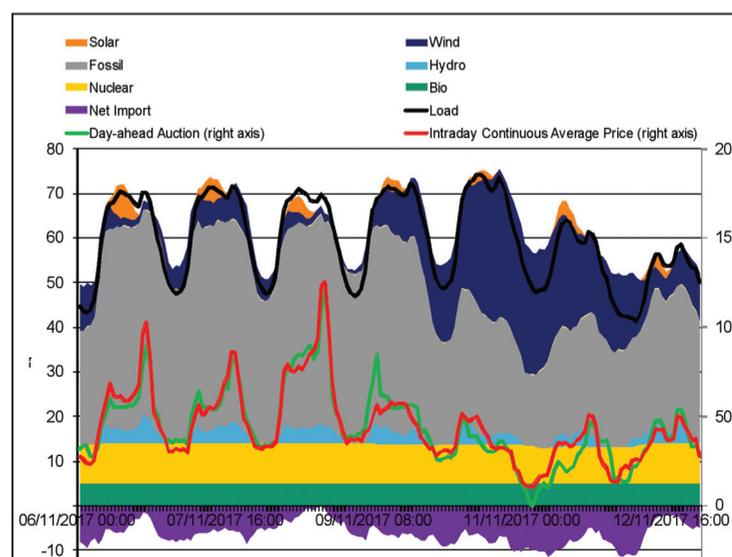
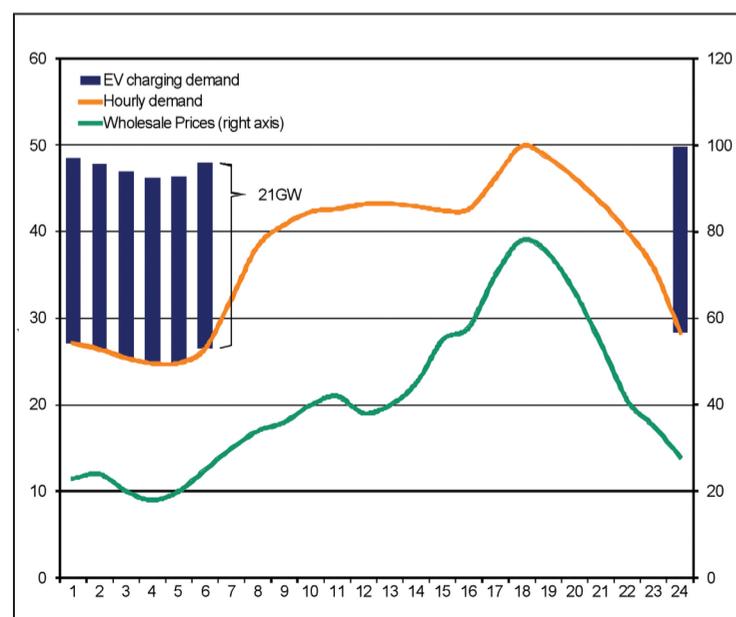
So we may find that the problems that EVs cause in the future are actually solved by EVs themselves.

This will be the case as long as the correct price signals are seen. And this may mean having a new electricity market design fit for the future that prices not only the electrical energy dynamically during the day, but also the grid congestion on the same basis down to a local level. It is uncertain exactly how EVs may develop and given this uncertainty a flexible pricing system may be the best solution to make the most of the flexibility they will bring.

The truth is that EVs will fundamentally challenge the whole of the electricity industry. Developments are already being seen in some markets but a huge amount of work remains to be done. If we are too slow to bring about these changes, we risk making generating capacity and grid investments in the shorter term that become unnecessary in the long-term and that will burden consumers with higher costs for years to come.

*Matt Brown is Vice President, Energy - Western Europe, Middle-East and Americas, Pöyry.*

**Filling the overnight trough: a winter day**



**Figure 2. Germany generation and prices for week 45, 2017.**  
Sources: 50 Hertz, Amprion, Tennet, TransnetBW, EEX, EPEXJ



# SMRs prepare to take the Gen 3 crown

Several third generation nuclear plants are under construction around the world but the challenges facing large nuclear new build projects are well documented. Recent developments with small modular reactors (SMRs) could provide the answer the industry has been looking for.

**David Appleyard**

**G**lobally, nuclear power is entering something of a renaissance as third generation (Gen 3) civil reactors establish a new breed of safer, more responsive and ostensibly cheaper nuclear reactor designs.

Based on the second generation designs that form the bulk of the current global fleet of operating nuclear reactors, Gen 3 systems include passive safety cooling to maintain core temperatures in the event of a power failure and better protection against aircraft impacts. Passive safety features, for example, include gravity-fed water supplies to flood the reactor and which do not require either power or manual intervention to activate.

Alongside improved safety characteristics, these later designs also nod to plant economics and the changing dynamic of the energy markets these reactors are expected to operate within. For instance, common features of these designs are a more standardised approach to reduce costs, together with higher efficiency operations and a longer operational life of 50-60 years. This compares with the current second generation lifespan of 20-30 years, a figure which can be increased by another 20 years or so if required.

Modular construction methods are also expected to curb costs by reducing construction times. Unlike previous generations of reactors, most of the Gen 3 and 3+ designs also enable load-following, with the ability to reduce output by as much as 75 per cent and ramp-up and down relatively quickly as required.

The bulk of Gen 3 designs are currently undergoing regulatory approvals to be licensed for construction by authorities such as the US Nuclear Regulatory Commission. In December, for instance, Hitachi Nuclear Energy Europe's UK Advanced Boiling Water Reactor (ABWR) reactor design was granted design approval. Horizon Nuclear Power plans to use the technology at its sites at Wylfa Newydd on the Isle of Anglesey in Wales and its Oldbury site in Gloucestershire, UK.

However, a few of these designs which have already received regulatory go-ahead are under construction. For example, EDF-Areva's European Pressurised Water Reactor (EPR) is under construction at Olkiluoto in Finland, Flamanville in France and the design is also expected to feature in Hinkley Point C in the UK. Two units are also under construction at Taishan in China, which are likely to

be the first in operation although all the EPRs currently under construction have been subject to delays.

Indeed, mainland China already has about 20 nuclear units of various designs currently under construction. With plans to increase nuclear capacity by about 70 per cent to reach some 58 GW by 2020, China is further anticipated to reach 150 GW of nuclear capacity by 2030. For example, Unit 3 of Tianwan reached first criticality in late December. Based on a Russian VVER-1000 design, Rostatom's Atomstroyexport or ASE Group conducted the construction of Tianwan together with Jiangsu Nuclear Power Corporation (JNPC). Commencement of commercial operations is planned for 2018.

Meanwhile, EPRs at the Taishan site in China are nearing completion by a consortium of China General Nuclear Power Corporation (CGN) together with EDF and Guangdong Yuedian Group. CGN and EDF are working closely to assess the design of the China-developed third-generation Hualong One (HPR1000) nuclear technology as part of a plan to build an export market with its domestic nuclear technology such as the CAP 1000 and the HPR 1000.

Russia is also pushing hard to export its nuclear technology with a raft of deals announced over recent months that look to put the Middle East at the centre of new nuclear development.

In December, for example, Egypt inked a deal with Russia's Rosatom to build the \$21 billion Dabaa nuclear power plant in the Matrouh region on the Mediterranean coast. With four reactors and a capacity of 5 GW, the installation is due to be completed in 2029 with the first unit coming on line in 2026.

December also saw first criticality procedures begin at Unit 1 of Leninograd NPP-2, a generation 3+ plant that is the basis of the El Dabaa project. Russian loans are expected to deliver around 85 per cent of the funding for the Egyptian nuclear project.

In Turkey, December saw the start of construction at the Akkuyu nuclear power plant under a limited construction licence issued by the Turkish Atomic Energy Agency (TAEK). Unit 1 of the 4800 MWe will take place. On completion, the plant will feature four VVER-1200 power units. A Generation 3+ design, Akkuyu's reactors are to be based on the Novovoronezh-2 project in Russia which was first commissioned in 2016.

Yet the challenges in developing

new nuclear technology and associated capacity have caused multiple delays and cost overruns, a seemingly perennial black mark against larger reactor developments. For example, although China's nuclear power goals are ambitious and the country typically excels at executing large infrastructure projects, both units at Taishan have reportedly been delayed – to 2018 and 2019, respectively – by the need for further design verification.

These challenges have in turn led to economic malaise for some nuclear technology firms. For example, in January it was revealed that Canada's Brookfield Business Partners L.P. and its institutional partners are to acquire the bankrupt Westinghouse Electric Company for approximately \$4.6 billion after reaching a deal with previous owners Toshiba. The acquisition is expected to close in the third quarter of 2018, subject to regulatory approvals.

Westinghouse had recently abandoned a two-reactor project by South Carolina Electric & Gas Company at the V.C. Summer Nuclear Station.

The ongoing challenges of large civil nuclear programmes has now prompted renewed interest in a generation of smaller, modular reactors or SMRs. These emerging SMR designs can potentially avoid the complexities, delays and overspend often associated with large infrastructure projects, like civil nuclear stations.

Indeed, one of the characteristics of many new generation 3 reactor designs is their relatively small size. For example, the Westinghouse Small Modular Reactor is a 225 MW integral PWR based on AP1000 technology, including its passive safety systems. As with their larger cousins, there is also a move to a more standardised approach.

SMRs could potentially be manufactured in factories like the aviation industry, slashing costs and the decades-long production lead times more typically associated with nuclear power projects.

The UK's National Nuclear Laboratory (NNL) published a feasibility study into the potential use of SMR technology in 2014, concluding that there is a very significant market for SMRs that cannot be met by large nuclear plants. The size of the SMR market could reach approximately 65-85 GW by 2035, and at a value of £250-£400 billion. The UK market for SMRs could be around 7 GW, the analysis concluded, noting that there is an opportunity for the UK to regain technology leadership.

In the wake of the NNL analysis, in 2016 the UK government launched a competition to consider SMR designs of up to 300 MWe, and which are able to achieve in-factory production of modular components or systems amounting to a minimum of 40 per cent of the total plant cost. That competition closed in December 2017, with a list of more than 30 eligible participants including companies such as NuScale Power LLC, Rolls-Royce, Westinghouse, Urenco and China National Nuclear Corporation (CNNC).

For the next phase of the modular reactor programme organisations can apply for a share of up to £4 million to develop feasibility projects. Up to £40 million of further funding may be available for development, subject to government approval. Further details on the UK's SMR support are expected to emerge early this year.

As an eligible participant Rolls-Royce is leading a consortium of companies including Amec Foster Wheeler, Arup, Laing O'Rourke and Nuvia in designing a small modular reactor power station that aims to produce electricity for as low as £60/MWh.

The increased interest in SMR technology has also prompted interest beyond the UK.

Late last year, Rolls-Royce and state-owned Jordan Atomic Energy Commission (JAEC) revealed plans for a feasibility study on the construction of an SMR in the Middle Eastern nation. This followed a similar agreement between Rosatom and Jordan which is also exploring the feasibility of SMRs. Last November, the JAEC and X Energy also announced an agreement for assessing X-energy's SMR technology – the Xe-100 – and its potential for deployment in Jordan.

Meanwhile, Rosatom and the King of Saudi Arabia, Salman bin Abdulaziz bin Abdul Rahman bin Saud, also recently agreed a roadmap to cooperate in the field of small and medium reactors that could be used for both power generation and water desalination.

Regulatory design approval is still some way off for SMR technology, which is at an early stage of technical development. However, the potential advantages of a broad SMR roll-out are significant. The rise of the small modular reactor could reinvigorate nuclear development across western Europe, the USA and elsewhere. This could see SMRs ultimately dwarf the endeavours of their larger cousins.

# Transactive energy on trial

Brooklyn: home to a microgrid paving a new route to peer-to-peer energy trading

A micro-grid project in Brooklyn, New York, is trialling a peer-to-peer energy trading system. The first transactions were conducted in April 2016 and today, some 50 solar sites are participating in the project. David Appleyard reports.

In the New York borough of Brooklyn a micro-grid project is paving a new route to peer-to-peer energy trading. Just a stone's throw from Manhattan and Wall Street, this new transactive energy world is being powered by blockchain, the secure data transfer protocol that powers the bitcoin virtual currency.

At the heart of the system is a high speed and secure mechanism to transfer data and assign a monetary value. For energy transactions these data represent, for example, power generated from a solar system, battery charge state, and demand – much of which is within the realm of the current generation of smart meters. What's different about this system is the speed of data transfer and the value function that enables users to take part in an energy market previously reserved for major players.

LO3 Energy, founded in 2013 by Lawrence Orsini and Bill Collins, is the company behind the transactive energy system. CEO Orsini outlines the thinking behind the blockchain model: "As we move towards this world where you have distributed energy it causes issues for existing utility business models, existing retailer business models and the physical grid itself. The only way to efficiently manage a grid with a high proportion of distributed generation is to allow devices on the grid edge to transact between themselves. There is no command and control system that can manage a billion devices at the grid edge efficiently."

Blockchain is an efficient and secure communication platform for value, but there are some significant differences between the crypto-currency version and that for the energy market, where speeds of a second or less are required to operate effectively. Nonetheless, just as blockchain offers an alternative approach to trading, buying and selling, so it enables consumers to make more choices when it comes to their energy use.

Using current transformers to measure energy data directly, as well as wireless communications protocols such as ZigBee and Z-Wave, data is

gathered from smart devices such as meters, vehicle chargers, intelligent fridges, light bulbs and the like to form a blockchain that enables secure communication. Although currently LO3 also produces smart meters with the required functionality and speedy data harvesting needed to operate energy transactions, at the heart of the company's IP is the transactive software and the applications that facilitate its use.

Scott Kessler, Business Development Director at LO3 Energy, explains: "You don't have to dictate what device the consumer is going to buy. As long as they're buying smart devices that's on one of these standard protocols – and the vast majority of manufacturers these days are on one of the standard protocols – the hardware backbone of the system is the meters talking to one another."

He adds: "We are testing this with all sorts of devices, we don't want this to only be useful to a certain type of building, we don't want it to be only useful to a certain type of home."

The ability to ascribe a value function allows participants to apply their personal values to energy trading. For example, consumers may elect to purchase renewable or green energy only. Applying this type of value judgement is possible already as consumers may purchase green energy from a utility company of their choosing. The blockchain-enabled transactive energy market allows consumers to take a far more sophisticated approach to their energy choices though. It allows the sale and purchase of energy produced locally and directly between participants, without recourse to the utility.

Using an application developed by LO3 Energy, participants in the Brooklyn microgrid programme are able to input value limits that see the system apply those values to purchasing decisions.

For example, a householder within the community may have a PV installation and associated storage capacity. They are able to offer those services to the market at a pre-determined price. A neighbour could decide that they want to buy not just green energy – which may in fact be represented by a Renewable Energy Certificate (REC) associated with a project in a completely different state – but the energy from a specific neighbourhood renewable installation. They may instead choose to buy green energy up to a maximum daily expenditure, they may choose to exclude nuclear power; a whole slew of different approaches are possible.

The blockchain communication gathers energy production, consumption, battery charge state and pricing preferences then – under the right circumstances – executes a trade. A final step will see the effects of that transaction replicated in the associated smart device, say, noting that 5 kWh have been sold from a battery system.

Kessler explains: "Our mobile app serves as the customer touch point, but really it's just talking to the meter and striking transactions. They call that a 'smart contract' – a little piece of software that I've told that at 5 US cents/kWh I'm willing to do something, at 25 cents/kWh do something else, whether that's buying energy or discharging a battery for example."

Using a tool to directly link prices with energy choices, including local neighbourhood-produced power, engenders an opportunity for novel financial models. Orsini said: "It's pairing traditional finance with community investment."

Community engagement is a key part of the microgrid roll-out and transactional energy markets, given that such tools may be used to incentivise certain energy choices. Kessler notes: "Depending on what the different users in the market want to buy you could have brown [fossil] energy be the most expensive one in theory. The whole point of this is to give the community what they want."

Another concept that is easily engendered through transactional peer-to-peer energy trading is the 'negawatt', or demand response approaches to consumption. Kessler explains: "The grid doesn't really care if I'm generating new energy or I'm reducing demand, it just wants to stay balanced. I can treat negawatts as a viable source just like solar or wind as long as I know the amount of resource I have and as long as I can guarantee that I'm able to deliver on my bid."

Although the price of a negawatt to a domestic or small business consumer is currently uncharted territory, in theory it's one of the most effective ways to manage the grid.

Another potential opportunity stems from location-based pricing. Currently, grid costs are socialised, that is each consumer pays an equal amount for transmission and distribution infrastructure through regulated wires businesses. But, with sufficiently detailed transactional data, it is possible to determine how much infrastructure has actually been used to facilitate that transaction. As Orsini notes: "If they are down the street from one another and they're only using a few strands of copper, that's a pretty cheap transaction. If they're going through the transformer and substation then they're using more, they should pay more."

Based in Brooklyn, LO3 Energy chose the borough for this roll-out of its microgrid and associated technology as it is a diverse neighbourhood that spans a number of different energy distribution networks, some of which are severely constrained, and numerous property types. The first transactions were conducted in April 2016 and today, some 50 solar sites are participating in the project.

In May further expansion was slated having won a \$5 million grant

from the US Energy Department programme to support micro-investments. "Those who invest will get a monthly return and will be able to decide whether to reduce their own bills or profit by selling the energy within the local community," explained Orsini.

In addition to the Brooklyn microgrid and a project starting in Sacramento in California, LO3 Energy is also conducting trials in South Australia and recently announced two new trials that are set to take place in Germany. Partnering with the Karlsruhe Institute of Technology (KIT) in cooperation with local energy provider, EnergieSudwest, a project will be set up in Lazarettgarten in Landau. The Lazarettgarten microgrid will be established in a 3.8 ha community with 130 residences and 19 businesses. As part of the project they plan to install solar PV and battery storage in these properties.

In the Allgäu region of Southern Germany a short-run proof of concept project with Allgauer Überlandwerk GmbH will see some prosumers selected to participate in a 'virtual microgrid'.

LO3 Energy has also been collaborating with Siemens since November 2016 to jointly develop microgrid technology that enables local energy trading. Backed by Siemens' next47 business unit, the plan is to incorporate the blockchain platform into the Spectrum 7 microgrid PLC. Backed by Siemens and with multiple technology trials under way, in a funding round announced last October, LO3 Energy secured investments from VC firms Braemar Energy Ventures and Centrica Innovations. Specific terms were not disclosed.

As utilities are increasingly challenged by the changing energy marketplace, peer-to-peer trading across grid edge devices offers up opportunities not only to more effectively manage grid stability issues using virtual inertia, demand side response or other techniques, but a host of other novel market mechanisms become possible.

As Orsini observes: "For too long it's been easy for the electricity industry to say 'people don't care about energy, they just want cheap power'. What we're really finding here is that's not the case at all – if you give them a way to engage with something in a new way that makes sense to them and their values they will take to it. Exposing people to markets is what's going to give these smart devices value."

The ability to cheaply, quickly and securely manage grid edge devices in response to signals from the grid – prices to devices – suggests new revenue streams and a new model for the utility to manage the grid. And as Orsini says: "The march of technology will not be halted, it's not going to stop, the genie is out of the bottle. We position ourselves as the company that's showing what the market of the future looks like."

LO3 smart meters have the required functionality and speedy data harvesting needed to operate energy transactions but at the heart of the company's IP is the transactive software





Junior Isles

# Flying ever closer to the sun

In recent years, renewable energy, and particularly solar, has probably been the brightest story in the power industry. Yet like any industry, it will face challenges along its journey to maturity.

According to the International Energy Agency's (IEA) Renewables 2017 report published in October, renewables accounted for almost two-thirds of net new power capacity around the world in 2016. This was another record year, largely as a result of booming solar PV deployment in China and around the world.

The report stated that solar PV is "entering a new era". For the next five years, solar PV represents the largest annual capacity additions for renewables, well above wind and hydro. The agency said "this marks a turning point" and underpins its "more opti-

mistic" solar PV forecast, revised up by over one-third compared to the previous year's report.

In 2016, new solar PV capacity around the world grew by 50 per cent, reaching over 74 GW, with China accounting for almost half of this expansion. For the first time, solar PV additions rose faster than any other fuel, surpassing the net growth in coal.

The IEA's improved solar forecast is driven by continuous technology cost reductions and unprecedented market dynamics in China as a consequence of policy changes.

Bloomberg New Energy Finance (BNEF) reported similar findings in its more recent 2017 clean energy investment trends. Annual figures based on its world-leading database of projects and deals, show that

global investment in renewable energy and energy-smart technologies reached \$333.5 billion last year, up 3 per cent from a revised \$324.6 billion in 2016, and only 7 per cent short of the record figure of \$360.3 billion, reached in 2015.

Solar led the way in clean energy investment, attracting 48 per cent of the global total for all of clean energy investment. Solar investment globally amounted to \$160.8 billion in 2017, up 18 per cent on the previous year despite technology cost reductions.

Just over half of that world total, some \$86.5 billion, was spent in China. This was 58 per cent higher than in 2016, with an estimated 53 GW of PV capacity installed – up from 30 GW in 2016.

Jon Moore, Chief Executive of BNEF, commented: "The 2017 total is all the more remarkable when you consider that capital costs for the leading technology – solar – continue to fall sharply. Typical utility-scale PV systems were about 25 per cent cheaper per megawatt last year than they were two years earlier."

The ongoing success of solar has seen more companies circling ever closer to the sun. In December, oil and gas major BP announced that it will invest \$200 million over three years in Lightsource, the largest solar energy developer in Europe.

The move marks a renewed focus on a sector it abandoned several years ago, and reflects the company's own market predictions. According to BP's *Statistical Review of World Energy*, global installed solar generating capacity more than tripled in the last four years and grew by over 30 per cent in 2016 alone. BP's Energy Outlook analysis sees solar as likely to generate around a third of the world's total renewable power and up to ten per cent of total global power by 2035.

Commenting on the move, Bob Dudley, BP group chief executive, said: "... we're excited to be coming back to solar, but in a new and very different way. While our history in the solar industry was centred on manufacturing panels, Lightsource BP will instead grow value through developing and managing major solar projects around the world."

Another move in recent months that demonstrates the growing interest in solar, was Fortum's agreement to acquire three solar power companies from Hevel Group, Russia's largest integrated solar power company. Fortum currently operates 85 MW of solar capacity in India and an additional 100 MW was estimated to be commissioned during 2017. Based on Fortum's strategy, the target is to create a gigawatt-scale solar and wind portfolio.

One of the biggest acquisitions of solar assets in 2017 was made by Brookfield Renewable Partners L.P. In October, Brookfield, together with its institutional partners, closed the acquisition of a 51 per cent interest in the purchase of 'yieldco' TerraForm Power (TERP). The deal saw Brookfield acquire a large scale, diversified portfolio of solar and wind assets located predominantly in the US, for a total commitment of \$656 million. The acquisition will add 2600 MW of solar and wind to Brookfield's portfolio. Shortly after, Brookfield, again with its institutional partners, acquired 100

per cent of sister yieldco TerraForm Global for a total net investment of \$750 million, adding a further 952 MW of wind and solar.

While such deals are an indication of a maturing sector, investors still need to be aware of the potential perils. Firstly, investors have to be sure that assets are valued appropriately and capable, from a technical and financial perspective, of performing in line with expectations.

RINA, a global corporation providing testing, inspection, certification and consulting engineering services, acted on behalf of Brookfield as technical advisers on the Terraform acquisitions, which it says represents 1.4 GW of solar assets.

Sion Haswell, Business Development and Operations Manager (Americas) at RINA said: "Large scale asset acquisitions are creating significant momentum in the international solar market but bring unique challenges."

Determining the yield from assets is a key area of risk. Ugo Salerno, Chairman and CEO, RINA, noted: "Making forecasts for 15-20 years is always extremely difficult."

RINA notes, however, that yields on solar are easier to predict than in wind. Simon Turner, Technical Director, Power and Renewables, said: "There is already a lot of equipment installed, which has been measuring sunlight for 20-30 years. So the historical trends can be used to predict what the sunlight will be for the next 15-20 years."

Panel deterioration is also a consideration. Turner says RINA builds-in degradation rates of 0.5-1 per cent a year into the models it presents to banks. "Banks will also look at probability scenarios for varying amounts of sunlight or particular yields. Probabilities could vary from a 'P99' (a probability of 99) for a worst-case scenario. They then use these probability scenarios to finance or size its debt," he said.

In new build projects, other ways of mitigating risks are through the contracts, RINA noted. Funders rely heavily on construction and operation and maintenance contracts, which include performance guarantees and warranties.

Yet no amount of preparation can prepare for sudden changes in regulation and legislation.

In late January US President Donald Trump announced 30 per cent tariffs on solar cells and panels imported into the US to protect domestic manufacturers. The decision will no doubt affect the competitiveness of solar in the US, the second biggest market after China.

"The industry will live but the deployment boom in the US will slow," said Varun Sivaram of the Council on Foreign Relations.

The fall in deployment will likely result in job losses, and companies that have acquired companies that have portfolios with a significant project pipeline in the US will probably see a hit on revenue and profit forecasts.

These are the potential hazards of investing in "new" technology.

Still, the sun has far from set on the industry. Solar, like any energy source in its infancy, will face challenges but will keep on growing. And in the meantime, companies will continue to fly closer to the sun.



Cartoon: jemsoar.com