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US states line up to fight ACE rule

The Trump administration's proposal to replace the Clean Power Plan is heading for the court room

A plan to replace the Obama-era Clean Power Plan with the Affordable Clean Energy rule is facing a legal challenge as climate concerns mount. **Junior Isles**

The US Environmental Protection Agency's (EPA) proposal to replace the Obama-era Clean Power Plan (CPP) with the Affordable Clean Energy (ACE) looks set for a long battle in the US court room.

In August, a coalition of 29 states and cities filed a lawsuit in the US Circuit Court of Appeals for the District of Columbia, challenging the new rule on grounds that it violates the federal Clean Air Act.

Essentially, the new rule abandons the CPP's incentives for utilities to shift from coal to cleaner-burning natural gas or renewables, or join a regional carbon trading scheme that caps emissions and lets generators buy and sell pollution permits. Instead, the ACE rule dictates that power plants can only reduce emissions with technologies that work "inside the fence-line", meaning retrofits that capture or reduce gases from individual plants.

A legal memo by law firm O'Melveny & Myers explained the legal background of the new rule and the CPP it replaces.

"Both the ACE Rule and the CPP are predicated on Section 111(d) of the Clean Air Act, 42 U.S.C. Section 7411(d), which allows the EPA to require states to submit state implementation plan (SIP) amendments that adopt standards of performance for stationary sources as to air pollutants for which air quality criteria have not been issued.

"Under Section 111(d), SIP amendments must establish standards of performance that reflect the degree of emissions limitation achievable through the application of the 'best system of emission reduction (BSER)... adequately demonstrated', taking into account the cost of achieving such reduction while also considering any non-air-quality health and environmental impacts and energy requirements.

"The new ACE Rule, which replaces the CPP, specifies as BSER heat rate improvement (i.e., improved efficiency), eliminating the use of outside-the-fence-line control measures. The ACE Rule also omits specifying numerical emission rates."

The EPA says its rule focuses on clean air standards aimed at reducing carbon dioxide emissions from existing coal fired power plants. The agency says improving the efficiency of coal fired plants, as measured by the amount of fuel required to produce a unit of electricity, is the best way of reducing emissions.

It is promoting six "candidate technologies" for power plants: neural network (computer model) control

Continued on Page 2

US leads on corporate clean energy PPAs

Although many question the US Trump Administration's clean energy credentials, a recent report by BloombergNEF (BNEF) has revealed that the country is the global leader in corporate Power Purchase Agreements (PPAs).

Corporations signed contracts to purchase 8.6 GW of clean energy in 2019 through July. This is up from 7.2 GW at the same time last year. Overall, 2019 is on track to be bigger than 2018 for corporate PPAs globally. The US made up 69 per cent of this activity – by far the biggest market globally.

US corporations bought 5.95 GW of clean energy in 2019, closing in on the 2018 total. Companies are once again flocking to Texas – historically the largest corporate procurement market in the country – where 40 per cent of the activity in 2019 has occurred. Companies are signing solar PPAs in ERCOT to take advantage of peak pricing during the hot summer months, which greatly improves the economics on a deal.

BNEF said in a release: "Just 1 GW of deals in the US have come from green tariffs with regulated utilities. It is likely we won't reach the 2.6 GW seen in all of 2018. This may be a result of buyer apprehension, as several companies have been involved in highly publicized legal battles with regulated utilities over clean energy buying." It also noted that companies are instead "favouring the virtual PPA model, which has made up 82 per cent of all US deals in 2019".

RE100 members will need to buy an extra 189 TWh of clean power in 2030 to hit targets. Despite 33 new companies joining the RE100 in 2019 through July, for a total of 191 signatories, BNEF forecasts that the group is collectively facing a shortfall of 189 TWh in 2030 – 1 TWh less than its previous forecast.

Existing RE100 members signed deals for an estimated 7.8 TWh of clean electricity, outpacing the demand from new signatories overall. Should these companies meet their 189 TWh shortfall through solar and wind PPAs, BNEF estimates it would stimulate an additional 94 GW of renewables build, leading to $97 billion of new investment.

Corporations have purchased just 950 MW of clean energy through PPAs in Europe, Middle East and Africa in 2019. The Nordics, which typically sets the pace for the region, has seen just 300 MW of deals, though several solar PPAs in Sweden are the first of their kind.

"There is excitement in new European markets like Poland and France, and a groundbreaking deal was signed by an oil and gas company in Oman, but otherwise the region continues to be underwhelming as a whole," said BNEF.

China is on the verge of rolling out game-changing policies for corporate procurement. Policymakers are set to implement two key policies. The first is a renewable portfolio standard, mandating that corporations meet a percentage of their load with renewables. The second is a prosumer model, allowing companies to sell excess generation from their own clean energy projects to neighbouring sources of demand. Both mechanisms will create more corporate demand and give companies flexibility in how they procure renewables in China.

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devices and intelligent soot blowers; boiler feed pumps; air heater and duct leakage control; variable frequency drives; blade path upgrades; and redesign or replacement of economizer.

Upon announcing the rules in June, EPA administrator Andrew Wheeler said the Obama regulations would have been too costly for low- and middle-income families.

Herring: the new rule barely mentions climate change

He also said the new plan would reduce emissions by 32 per cent below 2005 levels by 2030.

Mark Herring Attorney General of Virginia, one of the states opposing the new rule, notes, however, that the EPA's approach would reduce emissions by only 0.7 per cent more by 2030 than if no rule existed. He said that was according to the EPA's own analysis, which also found that emissions of at least of three pollutants – carbon dioxide, nitrogen oxides (NOx), and sulphur dioxide – would increase in 18 states in 2030.

Herring said he is concerned because the new rule barely mentions climate change, adding that Virginia "is particularly susceptible to the devastating effects" of climate change and sea level rise. "The Trump Administration has made no attempts to even pretend like they are concerned about climate change in our country and this replacement of the Clean Power Plan makes that painfully obvious."

On June 19, 2019, the EPA finalised the ACE Rule regulating greenhouse gas (GHG) emissions from existing coal fired power plants. At the same time, it finalised two related rules repealing the 2015 CPP and regulating federal and state implementation of the ACE Rule and any future emission guidelines promulgated by the EPA under Section 111(d) of the Clean Air Act.

The rules give states three years to develop plans to implement the new requirements and a further year for the EPA to evaluate the same. The EPA also notes that the states have "broad" discretion in establishing and applying applicable emission standards.

Many see ACE as part of President Donald Trump's campaign to support the coal industry by supporting the ailing coal fired power sector.

According to US Energy Information Administration (EIA) data released at the end of July, operators of coal fired power plants announced the retirement of 546 coal fired power units totalling 102 GW of capacity between 2010 and the first quarter of 2019. The majority of retirements came in 2015, with 15 GW (mostly 130 MW units with 56 years of operation), followed by 2018 with 13 GW (mostly 350 MW units with 46 years of operation). Another 17 GW of coal fired capacity will be retired by the end of 2025, including 7 GW by the end of 2019.

Ofgem investigates UK power outage

A major blackout in the UK has called into question the network's resilience as more renewables come onto the system, triggering an inquiry by the energy regulator. **Junior Isles**

Britain's energy regulator, Ofgem, is to launch its own investigation as to whether National Grid and several local electricity network operators breached their licence conditions, following the country's biggest power outage in a decade.

Any punishment could involve a fine of 10 per cent of the firms' turnover, an order to pay money to charities to help less well-off consumers, or to put cash into a fund to compensate those who lost out because of the power cuts. The outage left almost 1 million consumers without power for up to 45 minutes.

The probe will also examine the operating practices of Ørsted, which owns the Hornsea offshore wind farm and RWE, which owns the Little Barford gas fired power station near Cambridge. Both plants tripped following a lightning strike that hit a transmission circuit north of London.

The regulator has decided to carry out its own investigation following an interim report issued by National Grid immediately after the blackout on August 9th. The report from National Grid, which manages the transmission system, focused on why both Hornsea and Little Barford suddenly reduced their supply of electricity to the grid following the lightning strike.

Immediately after the lightning strike and within seconds of each other, both the wind farm and gas plant reduced supply, causing a loss of nearly 1.4 GW of generation and triggering a drop in frequency to 48.8 Hz, below the limit at which point the network becomes unstable.

As a result, the system automatically disconnected customers on the distribution network, resulting in about five per cent of electricity demand being turned off to protect the rest of the network.

Ofgem says that having read the interim report, it felt there were still areas where it needs to use its "statutory powers to investigate these outages".

Jonathan Brearley, Ofgem's Executive Director of systems and networks, said the regulator's own probe would ensure the industry learns the relevant lessons and clearly establish whether any firm breached their obligations to deliver secure power supplies to consumers. "It's important that the industry takes all possible steps to prevent this happening again," he said.

Notably, Ofgem plans to examine whether National Grid holds sufficient reserves of rapid response back-up power such as batteries that can supply electricity to the system if a generator fails.

Some observers have noted that the increasing amount of renewables on the grid is leading to greater network instability. Justin Bowden, National Secretary of the energy union GMB said: "National Grid must make sure it has enough spare capacity to cope with unexpected outages – which will only become more frequent as we switch over to renewables."

Tom Edwards Senior Modeller at Cornwall Insight, said, however: "This initial report highlights several reasons behind this rare event. The event itself was caused by settings and sensor issues in response to a lightning strike. Wind power was not directly responsible for the outage.

"National Grid was holding 1 GW of response to cover the immediate consequence of the largest in-feed loss of electricity at the time (the Interconnectors), but the overall loss of transmission connected generation was over 1.3 GW. In addition, an estimated 500 MW of generation capacity was lost on the distribution system at the same time as the lightning strike."

He said the outage highlights how increasingly interdependent and interconnected systems have become, and it is essential that the effects of embedded generation on the whole system are considered as part of operational security planning. Embedded generation is licence exemptible generation connected at the lower voltage distribution networks.

"The investigations will need to evaluate the way the National Grid assesses response and reserve given the changing mix of generation on the system and how services are provided and contracted for, including the liabilities on providers unable to fulfil their obligations.

Limejump, a tech company based in London that manages the largest portfolio of batteries in the United Kingdom in its Virtual Power Platform, said there are three things that should be done to remove the risk of this happening again. They are: procure and deliver a larger amount of faster-acting frequency response; create more inertia or limit the largest losses on the system; and incentivise a market reaction.

Erik Nygard, CEO, Limejump, said: "Above all, we need to build a system that can cope and design a market structure that is fit for modern generation and can adequately support the push towards net zero carbon and mitigate a far worse situation of cataclysmic climate change.

"It's important to keep in mind that a slowdown or reduction in our fight against climate change will create far worse consequences in the long term for our planet, society, economy and future generations than the most recent problems experienced in the blackout."

Scale-up needed for energy transition

Much more needs to be done around zero-carbon policy, investment and market design for a 2°C world to take hold, says a report by Wood Mackenzie. According to the firm's inaugural 'Energy Transition Outlook' the world will miss the sustainability goals set out in the Paris Agreement and is on a 3°C – not 2°C – warming trajectory.

David Brown, Head of markets and transitions, Americas, said: "To reach the 2°C goal, zero-carbon energy needs to account for 40 per cent of the total energy mix by 2040, compared with just 15 per cent we forecast in our Energy Transition Outlook.

"In context, zero-carbon energy contributed just 10 per cent to global demand last year. Of this, 8 per cent was supplied by nuclear and hydro, and 2 per cent by solar and wind plants. Yes, policy is becoming more supportive in some markets – the UK just legislated an economy-wide net-zero carbon pathway by 2050 – but other large, energy-dense markets have made little to no progress."

The report said the most developed markets are on course to reach just 50 per cent renewables by 2040. "Several constraints – current technologies, design rules, as well as costs – mean that markets have to turn to gas or coal plants to meet demand," said Brown.

It said, however, that the cost of renewable power is falling rapidly and is the fastest growing source of energy supply globally. But reaching a fuel mix where 50 per cent or more of energy demand is met by solar and wind would require huge changes to infrastructure – from energy storage systems to modernised grids.

BloombergNEF (BNEF) recently reported that energy storage installations around the world will multiply exponentially, from a modest 9 GW/17 GWh deployed as of 2018 to 1095 GW/2850 GWh by 2040.

BNEF's 'Energy Storage Outlook' 2019 predicts a halving of lithium-ion battery costs per kilowatt-hour by 2030, as demand takes off in two different markets – stationary storage and electric vehicles. The report goes on to model the impact of this on a global electricity system increasingly penetrated by low-cost wind and solar.

Yayoi Sekine, energy storage analyst for BNEF and co-author of the report, said: "Two big changes this year are that we have raised our estimate of the investment that will go into energy storage by 2040 by more than $40 billion, and that we now think the majority of new capacity will be utility-scale, rather than behind-the-meter at homes and businesses."

Logan Goldie-Scot, Head of Energy Storage at BNEF, added: "In the near term, renewables-plus-storage, especially solar-plus-storage, has become a major driver for battery build. This is a new era of dispatchable renewables, based on new contract structures between developer and grid."

UN urges Asia to phase-out coal

The United Nations (UN) has urged Asian countries, which have more than two-thirds of the world's 2400 coal plants, to make a transition to clean energy to curb the global climate crisis.

Rachel Kyte, the Secretary-General's Special Representative for Sustainable Energy and Head of Sustainable Energy for All, and Luis Alfonso de Alba, the Secretary-General's Special Envoy for the 2019 Climate Summit, made the request in a video-conference with journalists.

"There is an extraordinary global focus on what is going on in Southeast Asia, and Asia more broadly, and it really is in this region where we will succeed or fail in the energy transition from fossil fuels to renewable energy," Kyte said.

The UN also put forward the economic case for ending construction of new coal fired plants by 2020, even for developing nations.

UN Secretary-General Antonio Guterres, said: "There is really no future for coal, it is not competitive by price over the life-cycle or an investment in power generation and it has such an extreme impact on human health, as well as on the planet."

Kyte argued that coal financing has become increasingly difficult due to opposition from international development banks and some private banks, which has led to the construction of many power plant projects being cancelled. The UN also advocated an end to fossil fuel subsidies.

Meanwhile, Luis de Alba said he was working on financing packages to support the energy transition.

The UN representatives also invited governments to present concrete and long-term energy proposals during the climate summit in New York on September 23rd.

The 12th Energy Storage World Forum: 8-10 October 2019, Rome will feature speakers from 16 Utilities, 2 IPPs, 2 C&Is, 7 Regulators from 19 countries. Join them for a fun-filled evening at the Pool Deck of Sheraton Roma Hotel on 8 Oct 2019 for a Gala Dinner to mingle with more attendees from companies such as TENNET, TRANSNET, TERNA, EKZ, KEPCO and UKRENERGO.

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Canada assesses Chalk River SMR

Canadian regulators have started the assessment process for a planned small modular reactor (SMR) at the Chalk River nuclear labs north of Ottowa.

The Canadian federal government has issued the notice of commencement of an environmental assessment (EA) for the project, proposed by Global First Power (GFP), with support from Ultra Safe Nuclear Corporation (USNC) and Ontario Power Generation (OPG).

The project is the first of its kind in Canada and would serve as a model for future global deployments of SMR technology, GFP says.

Joe Howieson, GFP's Chief Executive Officer, commented: "The start of the EA is an important step in this very thorough and thoughtful process. We look forward to continuing our engagement with indigenous communities, local residents, and other stakeholders."

The Chalk River project would be a 15 MWth (5 MWe) micro-modular reactor (MMR) plant designed to demonstrate the use of SMR technology as a viable, carbon-free source of energy. The EA will entail detailed studies of the project, while GFP will continue to provide the Canadian Nuclear Safety Commission (CNSC) with information to support the ongoing licence application process.

"Our MMR technology is designed with a great many safety, environmental and operational innovations and this project will allow us to demonstrate how our advanced technology can be essential in helping Canada meet its energy, environmental and climate goals," said Francesco Venneri, Chief Executive Officer, Ultra Safe Nuclear Corporation.

Ecuador seeks renewables developers

Ecuador is hoping to attract international private sector investors to a planned tender for renewable energy plants.

The government has officially announced plans for the development of a 110 MW wind farm and a 200 MW solar photovoltaic (PV) plant. Both projects will be granted to a developer under a concession awarded through a public selection process.

The Villonaco II and III wind power project is located in southern Ecuador, in the province of Loja and is expected to have a minimum installed capacity of 110 MW. The El Aromo PV project, located on the Ecuadorian coast in the province of Manabí, will have a minimum installed capacity of approximately 200 MW.

The projects will help to reduce Ecuador's reliance on hydropower and make it less susceptible to drought-driven energy shortages. Both projects will cost around $200 million to develop.

The government said that it is seeking to attract private Ecuadorian or international investors to design, finance, build, operate and maintain the projects. The wind farm will be offered under a 25-year concession and the solar PV plant under a 20-year contract.

The projects will benefit from a number of private investment incentives, the government said, adding that the tender would be launched at the end of August.

According to media reports, some 45 national and international companies attended a briefing on the upcoming tenders in Ecuador at the end of July.

State-owned utility CELEC said that the El Aromo solar project would connect to the grid via a 230 kV substation at San Juan de Manta. The PV project will create synergies with Ecuador's hydropower plants, it added.

Solar on top in MiniRen auction

- Auction aimed at small-scale renewables
- Elawan secures nine projects

A 'mini' renewable energy auction in Argentina has awarded around 260 MW of generating capacity to project developers in an effort to maintain momentum in the country's clean energy sector.

The 'MiniRen' tender results released last month show that solar photovoltaic (PV) projects emerged as the cheapest technology, followed by onshore wind. Biomass, biogas and small hydropower projects were also successful, according to the Argentine Energy Ministry.

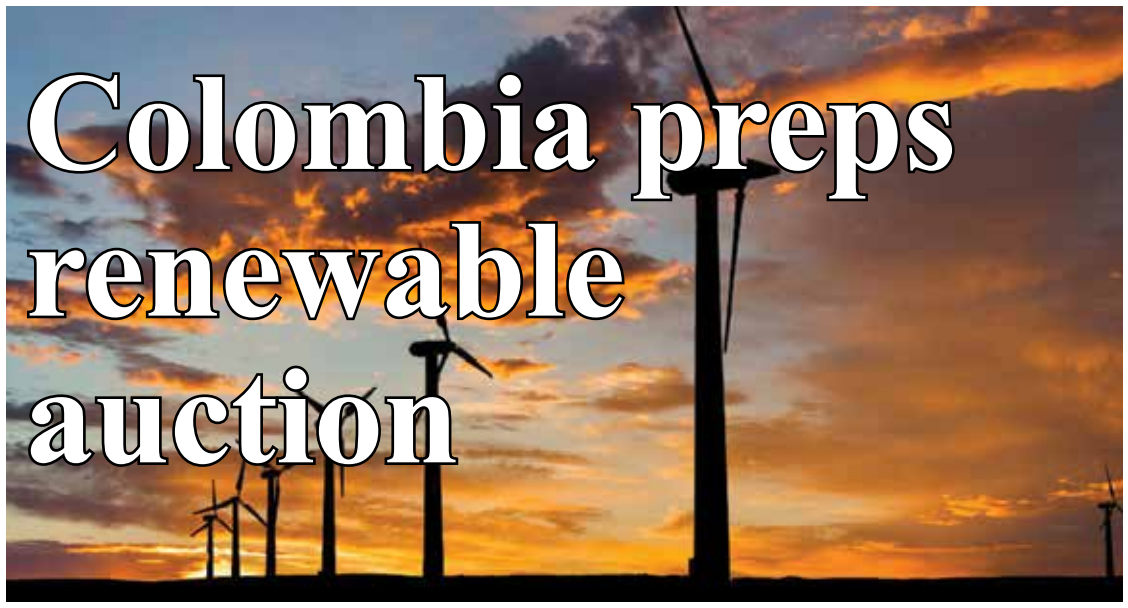
The MiniRen tender is part of Argentina's RenovAr clean energy programme and was aimed at small-scale generators connected at distribution network level and therefore unaffected by grid constraint issues. The projects will result in investments of more than $368 million, according to the Energy Ministry.

Ten wind power projects totalling 128.7 MW were contracted for an average price of $58.04/MWh, while 13 solar plants totalling 96.75 MW were contracted for $57.59/MWh, after a $60/MWh cap on prices was set.

Biomass, biogas and small hydro projects won a further 34 MW of capacity. Selected bidders were awarded 20-year PPAs with the Electricity Wholesale Market Administrator (CAMMESA). They also agreed to adhere to the FODER, a structure that guarantees payment to plants.

Elawan, formerly known as Gestamp, secured nine wind projects to be located in the regions of Buenos Aires, Cordoba, Santa Cruz and La Pampa. PE Adelia Maria won the other wind farm, which will be located in Cordoba.

- Equinor has acquired a 50 per cent stake in the 120 MW under construction Canadon Leon wind farm in Santa Cruz, Argentina. The Norwegian developer will make a $30 million equity investment as part of the deal that will see it subscribe to shares in developer Luz del Leon. After the deal, the latter will be 50 per cent owned by YPF Luz, which includes an affiliate of GE as a shareholder.



Colombia preps renewable auction

- AES buys wind portfolio
- Colombia changes auction parameters

Developers in Colombia are gearing up for the country's second renewable energy auction, due to take place in the second half of 2019.

AES Colombia has struck a deal to purchase a five-project wind portfolio from Colwind SA with a total capacity of 650 MW in preparation for the auction, a key component of Colombia's renewable energy programme.

The five wind farms are collectively known as the Jemeiwaa Kai complex and are in the late development phase. AES Colombia used DNV GL as a technical advisor on the purchase, it said.

"This will be the biggest wind project in the country, which will make us the leader in renewable power generation in the upcoming years. Our goal is to develop, in Colombia, the most competitive and sustainable portfolio in the entire energy sector," said Federico Echavarría, General Manager of AES Colombia.

DNV GL assisted AES Colombia in analysing the wind energy potential of the projects and in evaluating the performance and production of various manufacturers and models of wind turbines. The five projects – Apotolorru, Carrizal, Casa Eléctrica, Irraipa and Jotomana – could account for 40 per cent of Colombia's 2022 renewable energy goal.

Successful participants in Colombia's next auction will be awarded 12-year power purchase agreements. The country has set a goal of installing 1500 MW of non-conventional power generation by 2022.

In Colombia's first renewable auction, held in February, no projects won as they could not fulfill the indicators set by the authorities. The Colombian authorities have proposed a new model for the second round that features seven changes.

Solatio plans 7 GW solar investment

Renewable energy developers in Brazil are ramping up project activity.

Spain-based solar energy company Solatio has announced plans to invest BRL21 billion ($5.4 billion) in the development of solar photovoltaic capacity, while Brazilian power producer AES Tiete is working on a deal to takeover a 500 MW wind farm portfolio, according to reports.

Solatio Energia is to build 7212 MW of PV capacity in Minas Gerais state, spread across ten municipalities, according to the state government. It has finalised a decision to go ahead with development of the first 782 MW of capacity, requiring BRL2.5 billion of investment.

It will build the remaining 6430 MW of capacity over the next four years. Around 70 per cent of the planned PV capacity will be operational by the end of 2022, with the remaining online in 2023.

Output from the PV farms will be sold on the free market.

According to press reports last month, AES Tiete Energia, a subsidiary of USA-based developer AES, has secured an option to buy 500 MW of wind capacity in an advanced stage of development in Bahia state.

The energy company is in negotiations to close energy supply contracts that will enable it to proceed with the wind farms' development.

The company has also been working to fulfil precedent conditions of its agreement with Renova Energia for the acquisition of the 743 MW Alto Sertao III wind complex.

- Eletrobras, Latin America's largest power utility, has resumed the sale of 39 subsidiaries operating 980 MW of wind energy capacity and a transmission project in Brazil as part of plans to reduce debt. The company will offer the assets in six lots, it said.

India seeks to accelerate solar and wind

India is looking to accelerate the use of solar to alleviate peak demand, while attempting to further drive down the cost of wind. **Syed Ali**

India is looking to increase the deployment of solar and wind as part of an effort to meet peak demand.

The state enterprise Solar Energy Corporation of India (SECI) recently issued a tender for 1200 MW of renewable power that can be used to alleviate peak demand issued on the grid, in effect mandating the use of energy storage systems (ESS).

An invitation has been issued for bids to build, own and operate renewable generating facilities and enter into 25-year power purchase agreements (PPAs) with SECI. Solar and wind (or combined or hybrid systems) must be capable of dispatching power to the grid for at least six hours each day. Off-peak energy will be provided a flat tariff payment of Rs2.70/kWh ($0.038), while a separate peak tariff will be determined through e-Reverse Auction, the SECI invitation document said.

As long as the six-hour peak stipulation can be met, bidders have been given flexibility to determine the technologies used, type and power rating of the ESS portion of each project and maybe include but not be limited to batteries, pumped storage, mechanical, chemical or combinations thereof.

According to SECI, while India has already installed 80 GW of renewable energy, and ambitious policies including the National Solar Mission will push it further ahead, the inability of renewable generators to dispatch energy to the grid at times when it is most needed is a key factor in preventing wind and solar from displacing and replacing fossil fuels.

In late July the Federal Ministry of Power of India said India's coal fired power capacity is expected to increase by more than 22 per cent by 2022, as domestic electricity demand keeps on rising (though at a slower pace in the last four years).

Although India is making progress in shifting from coal to renewables, the ongoing drive to further ramp up solar and wind deployment is not without its challenges.

A recent tender by NTPC for 1.2 GW of solar PV projects received no bids, according to the *Economic Times*.

The tender sought projects at locations in the states of Maharashtra, Madhya Pradesh, Chhattisgarh and Gujarat, with connectivity through substations at existing NTPC thermal power plants. Proposals were capped at Rs2.78/kWh ($0.039/kWh).

Vinay Rustagi, Managing Director of renewable energy consultancy Bridge To India, told the newspaper that the reason for developers' lack of interest was the low ceiling tariff, considering the lower irradiation levels in the specific areas and the higher land cost. He added that the expectations for a viable tariff stand at about Rs3/kWh.

In another auction Gujarat Urja Vikas Nigam Limited (GUVNL) had requested the winning bidders in its recently concluded wind power auction to match the lowest bid of Rs2.8/kWh. Only two out of the eight developers that bid for the projects adhered to this request.

Pressuring developers after an auction to lower tariffs to match that of the lowest bidder is increasingly becoming a tactic to keep prices low.

Gujarat awarded 745 MW of wind projects to nine developers after an auction in May at tariffs ranging from Rs2.80 per unit to Rs2.95 per unit. The state distribution company asked all the winners to match the lowest tariff if they wanted power purchase contracts.

The state is within its rights to do this, but the auction process is getting eroded, Rustagi said. Tenders are routinely getting undersubscribed, cancelled or negotiated, so the process is becoming disjointed and creating uncertainty for the private sector.

Australia's coal proponents still hold sway

Australia's bid to preserve its coal industry is threatening the region's climate ambitions. Last month, Canberra blocked Pacific Islands leaders from agreeing on a joint declaration to tackle climate change.

After protracted negotiations at the Pacific Island Forum on the island nation of Tuvalu on August 16th, leaders from 18 countries watered down the official communiqué to accommodate concerns raised by the Australian government.

Australia's Prime Minister Scott Morrison, is a staunch supporter of the coal industry, which delivered A$67 billion ($45 billion) in export earnings in 2018 and provides nearly two-thirds of the country's electricity.

Morrison led Australia's negotiations on the Tuvalu declaration, which among other things called for more effort to tackle the world's "climate crisis" and a ban on new coal mines and coal power stations.

Pacific Island countries are lobbying developed nations to take more drastic action to tackle climate change, which scientists warn threatens the future existence of smaller archipelagos, such as Tuvalu and Kiribati.

Frank Bainimarama, Fiji's Prime Minister, expressed disappointment at the outcome of the meeting.

Australia's opposition Labor party criticised Morrison's stance on the joint declaration, saying it made Australia look like a "bad actor" on climate change.

The country is, however, well on its way to reaching its Renewable Energy Target (RET). In 2016, the Clean Energy Regulator (CER) estimated that reaching its 2020 RET of 33 000 GWh renewable power generation would require 6000 MW of green power generating capacity. Due to a higher proportion of solar projects in the pipeline, the estimates were later updated to 6400 MW. The country has already reached 6200 MW.

South Australia's conservative Liberal government has boasted that it has 10 GW of large scale wind and solar projects now in the development pipeline, propelling the state towards its anticipated milestone of net 100 per cent renewables by 2030.

Several notable projects in the state were announced last month. SIMEC Energy Australia won development approval for a 100 MW/100 MWh battery storage project that will be linked to its recently consented Cultana solar park, and a A$500 million wind-solar-battery facility capable of generating 275 MW was given the green light by the South Australian government.

The project being developed by French company Neoens Crystal Brook Energy Park will include up to 150 MW of solar, 130 MW/400 MWh of battery storage and 125 MW of wind from 26 wind turbines.

Meanwhile, in Queensland, Australia's largest wind farm, Coopers Gap, has begun generating electricity. The project remains on track for completion in the 2020 financial year.

Although the commissioning process is continuing, with almost 50 of the 123 turbines installed, at full capacity the 453 MW wind farm will generate enough renewable energy to power 264 000 average Australian homes.

■ The Australian electricity operator has recommended trialling new measures to manage the boom in rooftop solar and batteries and capitalise on the increasing flow of power from households back to the grid.

Renewables key to China hydrogen plan

China's plan to have 20 GW of wind turbines producing green hydrogen received a boost last month when Goldwind signed up as one of the first partners in a wind-to-hydrogen project in northeast China.

The project in the city of Baicheng, Jilin province, which also aims to eventually harness 15 GW of solar PV, is the largest yet announced in China to explicitly integrate renewable generation and hydrogen infrastructure within a so-called hydrogen valley. It will produce more than one million tonnes of the hydrogen annually by 2035.

Like other wind-rich areas of China, Baicheng's grid faces problems accommodating power from the 4.65 GW of existing wind and solar capacity serving the city, leading to curtailment of output. A hydrogen infrastructure is seen as an ideal outlet for putting unused generation potential to good use.

■ China plans to improve a subsidy application mechanism, just launched this year, to reduce subsidies in the solar photovoltaic sector, according to the National Energy Administration. The subsidy application mechanism was designed to boost market-oriented development in the solar pv sector and further reduce subsidies.

Japan to scale back feed-in tariffs

Japan has compiled a plan to scale down its feed-in tariff system. The plan was endorsed last month by the Ministry of Economy, Trade and Industry's expert panel, and the government aims to have a modified system approved by the Diet in 2020 to end support for electricity generated by wind and large-scale solar plants.

Under the current system, power companies are obliged to buy all electricity generated by renewable sources at fixed rates. But calls for the system's reform have grown as the higher price of such energy, passed onto households and companies via electricity bills, continued to rise and is expected to reach Yen3.6 trillion ($34.0 billion) in this fiscal year to March 2020.

The scheme was implemented in 2012 to reduce reliance on nuclear power following the crisis at the Fukushima Daiichi power plant triggered by the March 2011 earthquake and tsunami, and resulted in new suppliers flooding the power sector.

Power generated by renewable sources more than tripled and even raised concerns about transmission capacity. Ministry officials have said the cost passed on to the public and corporations has exceeded an initially anticipated level despite past attempts to address the issue including lowering the predetermined purchase price.

■ Tokyo Electric Power Company (Tepco) will dismantle all four reactors at another nuclear plant near the ruined Fukushima Daiichi nuclear power plant. The Fukushima Daini power station is located about 10 km south of Fukushima Daiichi, which suffered meltdowns in three of its six reactors.

Study trebles European wind potential

Europe could install over 50 TW of onshore wind capacity – enough to meet global demand to 2050, according to a new study.

Siân Crampsie

European aspirations for a 100 per cent renewable electricity grid are within reach, according to a new study of the region's potential for onshore wind energy capacity.

The analysis, from the University of Sussex in the United Kingdom, and Aarhus University, Denmark, finds that Europe has the capacity to produce more than 100 times the amount of energy it currently produces through onshore windfarms, and that the region could, in theory, supply enough energy for the whole world until 2050.

Europe's potential nameplate capacity for onshore wind is 52.5 TW – three times more than previously thought, according to the analysis. Current onshore wind installations stand at about 173 GW, according to Wind Europe.

The study is not designed to be a blueprint for wind development, the authors say. "Our study suggests that the horizon is bright for the onshore wind sector and that European aspirations for a 100 per cent renewable energy grid are within our collective grasp technologically," said Co-author Benjamin Sovacool, Professor of Energy Policy at the University of Sussex.

"Obviously, we are not saying that we should install turbines in all the identified sites but the study does show the huge wind power potential right across Europe which needs to be harnessed if we're to avert a climate catastrophe."

The study used detailed sub-national level GIS data to identify suitable sites for onshore wind farms across Europe. It estimates that more than 11 million additional wind turbines could be theoretically installed over almost 5 million km^2 of suitable terrain generating 497 EJ of energy – enough to meet the expected global energy demand in 2050 of 430 EJ (119 444.44 TWh).

The authors identified Turkey, Russia, and Norway as having the greatest potential for future wind power density, although large parts of Western Europe were also considered ripe for further onshore farms because of favourable wind speeds and flat areas.

Peter Enevoldsen, assistant professor in the Centre for Energy Technologies at Aarhus University, said: "Critics will no doubt argue that the naturally intermittent supply of wind makes onshore wind energy unsuitable to meet the global demand.

"But even without accounting for developments in wind turbine technology in the upcoming decades, onshore wind power is the cheapest mature source of renewable energy, and utilising the different wind regions in Europe is the key to meet the demand for a 100 per cent renewable and fully decarbonised energy system."

Onshore wind energy installations are currently slowing, Wind Europe says. The organisation's latest statistics show that 2.9 GW of onshore wind capacity was installed in the first half of 2019, lower than the 3.3 GW installed in the same period last year.

The slow-down is largely due to a permitting bottleneck in Germany, where 11 GW of onshore capacity is held up. It is expecting France and the Nordic countries to pick up the slack in the second half of the year.

"The EU has set a renewable energy target of 32 per cent for 2030 and is talking about a net zero economy by 2050," said WindEurope Chief Policy Officer Pierre Tardieu. "The rate of installations we've seen so far this year won't get us there."

Wind Europe expects 5.9 GW of onshore and offshore wind to be installed over the next 2-3 years.

UK auction faces legal challenge

A legal challenge to the UK's renewable energy auction is likely to cause delays to the latest bidding round.

Banks Renewables has confirmed that it has requested a judicial review of the auction, which awards long-term contracts for difference (CFD) to developers of renewable energy projects.

The onshore wind energy developer believes that the auction discriminates against onshore wind energy and other renewable energy technologies because it is only open to less established technologies, including offshore wind and tidal energy.

In a statement Banks said: "The company believes the exclusion of fully-consented onshore wind farms from the CFD process is against the public interest, prevents consumers from benefiting from the lower energy prices that would result from their inclusion and, from a legal perspective, does not comply with either EU or UK law."

The latest bidding round opened in August and is due to award contracts for up to 6 GW of capacity. Onshore wind energy projects located in the Scottish Islands are also eligible to bid.

Banks' application for a judicial review has forced the government to delay the auction and National Grid, which runs the scheme on behalf of the government, extended the bidding window by two weeks to August 29.

"We simply desire a level playing field, and believe consented onshore wind farms are legally entitled to participate in all CfD auction processes and to have an opportunity to access the aid necessary to construct consented sites," said Richard Dunkley, Managing Director at Banks Renewables. "The exclusion of the onshore sector is clearly contrary to the open, transparent and non-discriminatory way in which the CfD scheme was expected to work."

The UK government said it would contest Banks' claim, noting that the CFD auction process is run "lawfully". Banks has two consented onshore projects in Scotland with a combined capacity of 150 MW.

Onshore wind energy growth in the UK has slowed dramatically since the closure of the Renewables Obligation and the exclusion of the technology from the CFD scheme.

However the industry argues that onshore wind is needed in order for the UK to meet its 2050 net-zero climate goal.

Belgian reactor decision "unlawful"

Belgium's decision to keep two nuclear power plants operational beyond their 40-year operational lives was flawed, according to a ruling by the European Court of Justice.

The country's parliament had agreed to prolong the operating lives of the Doel 1 and 2 reactors beyond their planned 2015 closure to prevent power shortages. However, in response to a case brought by two environmental groups, the European Court of Justice said at the end of July that Belgium's government had breached EU law.

According to the Court's ruling, Belgium should have carried out environmental impact studies before prolonging the reactors' lives. It must now conduct environmental assessments and demonstrate that there is a "genuine and serious threat" of power cuts if the plants are closed.

And, as the Doel 1 and Doel 2 reactors are on a site close to the Dutch border, the Netherlands must be involved in a "transboundary assessment procedure".

The Belgian constitutional court will now decide the fate of the power stations, taking into account the legal interpretation of the ECJ. The country's grid operator, Elia, has warned of a serious crisis in energy supply if there is insufficient new capacity to replace nuclear retirements.

Belgium currently has seven reactors, four at the Doel power station and three in Tihange, in the east of the country between Namur and Liege. Operator Electrabel spent around €700 million refurbishing the Doel 1 and 2 reactors to ensure they could continue operating after receiving regulatory approval for the life extension.

EIB supports Spanish renewables drive

Alfanar has won €385 million of support from the European Investment Bank (EIB) for the construction of 21 wind farms in Spain.

The developer is building 547 MW of onshore wind capacity in Spain after winning contracts in a July 2017 renewable energy auction.

A deal for the first loan of €44.2 million has already been signed by the EIB and Alfanar, with further loans to follow for later phases of the development of the portfolio.

The first loan, together with additional funds from various financial institutions, will be provided via a project finance arrangement for the construction of the first four wind farms, which will have a capacity of around 99 MW.

The EIB said that the loan agreement was "a clear example" of the EIB's priorities in Spain, including promoting the transition to a low-carbon economy. Funds will be sourced from the Investment Plan for Europe known as the Juncker Plan.

The 547 MW Alfanar portfolio is one of the largest wind power projects financed by the EIB in Spain following its contribution to the financing of the Goya project. The projects will be located in Andalusia, Asturias, Castilla-La Mancha, Castilla Leon, Galicia and Navarra.

Alfanar Global Development General Manager Emmanuel Ozaez commented: "Over the next few years, Spain is set to be a European leader in the energy transition to a technology mix where renewable power generation is the central pillar of the energy industry.

Alfanar has gathered sound human and material resources in Spain, enabling us to implement a project portfolio of up to 3 GW for the 2019-2021 period developed, financed, built and operated by Alfanar and other strategic partners like the EIB."

Indian market ripe for CFBs

Stricter emission laws in India could see the country re-assessing its choice of technology for base load coal fired plants. With large-scale units now possible, combined with supercritical and ultra-supercritical parameters for high efficiency, circulating fluidised bed technology is now being considered by the government as an alternative to pulverised coal fired boilers. **Junior Isles**

Despite sluggish global economic growth, India's economy is forecast to grow at 7.0 per cent in 2019, picking up to 7.2 per cent in 2020, according to the International Monetary Fund.

As is always the case with rapidly growing economies, this will drive demand for new base load power generating capacity in order to meet new demand and maintain reserve margins.

Market expert Ravi Krishnan, at Krishnan Associates, commented: "Following a few years of a downward trend in the economy due to structural reforms, the signs are for stronger economic growth starting from this year. The need for base load generation has therefore become imminent. When there is good, solid, economic growth, like we had between 2008 and 2014, on average India adds about 15 000-20 000 MW of new capacity per year."

India has very little gas or oil. Therefore it largely depends on coal for base load generation. According to the Central Electricity Authority, coal accounted for nearly 56 per cent of system capacity in 2018/19. Most of this was fuelled by domestic coal, with imported coal only serving about 20 per cent of the coal fired installed base.

Traditionally, India has predominantly used pulverised coal (PC) technology but fairly recent tightening of emission regulations could see things change. "The market favoured PC technology and more so because there were no environmental regulations whatsoever for NOx and SO_2, and there was a relaxed standard for particulates as well… The new emission laws promulgated in 2016 means that any new power plant commissioned in India has to meet a standard of 100 mg/Nm^3 for NOx and SOx and designed for as low as 30 mg/Nm^3 for particulates," said Krishnan.

The new legislation sets different limits for plants installed before 2004, those after 2004 but before December 31, 2016 and those after January 1, 2017.

In short, the legislation means that plants pre-2017 of less than 500 MW have to meet SO_2 standards of less than 600 mg/Nm^3, and less than 200 mg/Nm^3 for plants larger than 500 MW. For NOx, the level is 600 mg/Nm^3 for all sizes built before 2004. For plants built between 2004 and 2017, the SO_2 limits are the same as pre-2004 plants but the NOx limit is 300 mg/Nm^3. Notably, in some locations units that are smaller than 500 MW but are close to populated areas, also have to comply with the 200 mg/Nm^3 SO_2 standard. For plants of any size built from January 2017, both SO_2 and NOx must not exceed 100 mg/Nm^3.

The legislation means that many PC plants have to be retrofitted with selective catalytic reduction (SCR) equipment to cut NOx, and flue gas desulphurisation (FGD) to control sulphur. This presents an opportunity for circulating fluidised bed (CFB) technology. As CFB technology is inherently cleaner, it does not require the additional equipment. Krishnan says this now makes it a lot more competitive with PC fired technology.

"Additionally, there has also been a focus on lowering CO_2; that has led a lot of power plant owners to look at blending different types of fuels and co-firing with biomass. So CFB technology has become a much stronger and more compelling alternative to PC fired power plants," Krishnan added.

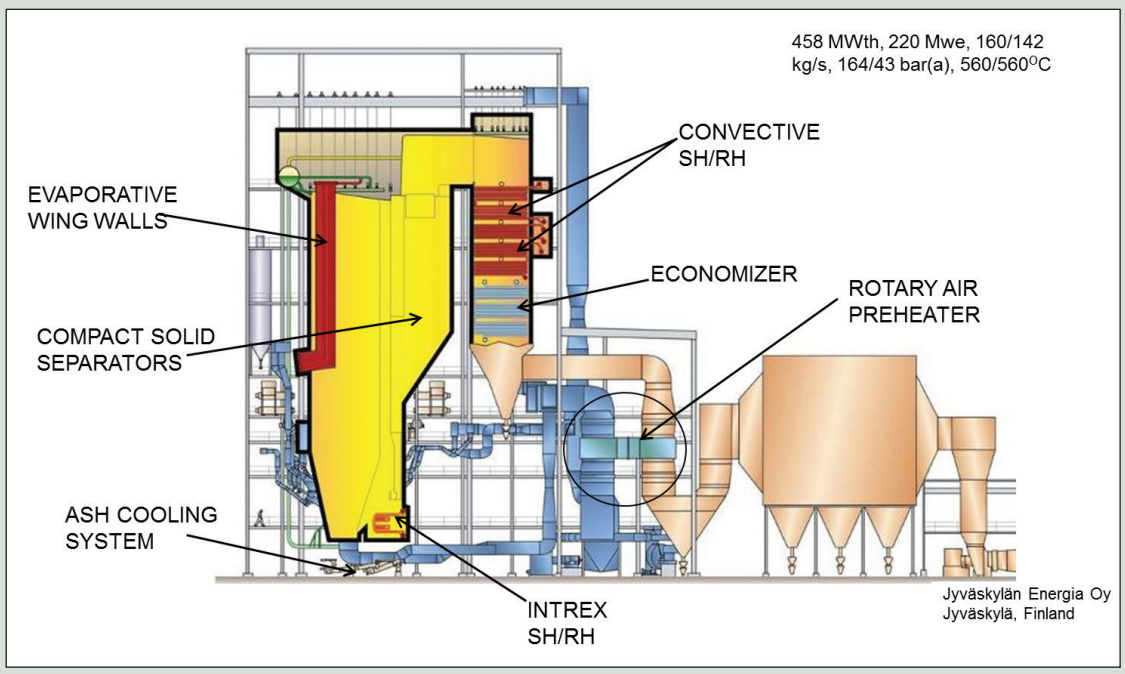
This thinking was highlighted in a Ministry of Power expert committee report published last year. The report notes that CFB has "several benefits" over PC boilers. "CFB boilers are extremely flexible, allowing a wide range of fuel qualities and sizes to be burned. Emissions of SOx and NOx are significantly reduced without the addition of expensive flue gas emissions control systems," it stated.

Over the last 25 years or so, Sumitomo SHI FW (SFW) has broadened both fuel flexibility and unit size so much that a growing number of power companies have taken notice. Many now see CFBs as a way to produce low cost power from low quality fuels such as brown coals, lignite, and waste coals, as well as, high-energy, hard-to-burn fuels like anthracite and petroleum coke.

They can also burn an almost "limitless number" of other types of solid fuels, separately or mixed with coal. "The limitations, if any, are only in the feeding system and other mechanical equipment," stated the report. Other solid fuels include bagasse in sugar plants, bark in pulp and paper mills, biomass products as well as, municipal solid waste. Mixing with coal when other fuels are not available gives uninterrupted steam and energy supply.

The CFB's ability to burn high ash, low calorific value coal is a big plus for the Indian market where coal typically has 30-40 per cent ash content. Robert Giglio, Senior Vice President of Strategic Business Development for SFW, noted that its technology can handle coals with up

SFW's circulating fluidised bed steam generating technology



to 60 per cent ash. He said: "India's domestic coal is ideal for CFBs. It's amazing that they have been firing that coal in PCs for as long as they have been, but it's much easier for the CFB because you don't have to deal with slagging ash, etc., and you can meet the new emission control standards without the expensive back-end equipment in what is a cost-sensitive market."

A CFB's ability to burn a broad range of fuels is due to its flameless, low-temperature combustion process at the heart of the technology. Unlike conventional PC or oil/gas boilers, instead of an open flame, circulating solids are used to achieve high combustion and heat transfer efficiency to burn a wide range of fuels. The fuel's ash does not melt or soften, which allows the CFB to avoid the fouling and corrosion problems encountered in conventional boilers.

"In a normal boiler the ash gets so hot it turns into a fouling material or slag and coats everything," noted Giglio. "The CFB uses the ash to support the process. It uses it to circulate and distribute the heat in the boiler evenly. It also keeps the surfaces clean. So instead of causing fouling, resulting in maintenance issues and frequent outages, etc., you can choose a different technology and solve a lot of these issues."

From an environmental aspect, the low temperature CFB combustion process – typically 800-900°C, which is significantly lower than in a PC boiler – minimises NOx formation and allows limestone to be fed directly into the furnace to capture SOx as the fuel burns. In most cases, a SCR and FGD are not needed for NOx and SOx control, dramatically reducing plant construction and operating cost and water consumption, while improving plant reliability and efficiency.

Since the fuel ash does not soften or melt in a CFB, the size of the furnace does not increase as much as PC boilers when firing lower quality fuels. In order to control fouling, slagging and corrosion, a PC furnace height typically increases by 45 per cent and its footprint by more than 60 per cent when firing low quality fuels such as high sodium lignite. With a CFB, boiler height increases by only 8 per cent and its footprint by only 20 per cent. This results in a smaller and lower cost CFB boiler as compared to the PC boiler for lower quality fuels.

Further, unlike a PC boiler, a CFB boiler does not need soot blowers to control the build-up of deposits and slag in the furnace since the circulating solids keep the furnace walls, panels and steam coils clean for the most efficient heat transfer.

Another important advantage of CFB boilers is their ability to withstand the corrosion that can occur when certain fuels are burned. In a boiler, final superheat and reheat steam coils operate at the highest metal temperatures, making them the most vulnerable to corrosion and fouling attack.

In a PC or oil/gas boiler, these coils are hung from the furnace ceiling and are directly exposed to the slagging ash and corrosive gases (sodium and potassium chlorides) in the hot furnace flue gas. To cope with this undesirable situation, boiler designers use expensive high-grade alloys and recommend a high level of cleaning and maintenance for these coils.

This is avoided in SFW's CFBs by submerging these coils in hot solids, fluidised by clean air in heat exchanger compartments called INTREXs, protecting them from the corrosive flue gas. The bubbling hot solids efficiently conduct their heat to the steam contained in the coils and since the solids never melt or soften, fouling and corrosion of these coils are minimal.

Further, due to the high heat transfer rate of the solids (via conduction heat transfer), the final superheat and reheat coil sizes are many times smaller than the pendent and convective coils in PCs saving more capital and operating cost.

In addition to recognising the fuel flexibility and new economic case for CFBs, the Indian government has also acknowledged that their much increased power output and efficiency makes them much more suitable for utility scale application than in the past.

The report stated: "Almost all of the existing CFBC power generating units are small in size (330 MWe compared to > 1000 MWe for a PC boiler), and use subcritical steam conditions that make CFBC systems less efficient than supercritical/ultra-supercritical PCC plants. The poorer economy of scale and lower efficiency of the CFBC plants result in higher plant costs and has limited deployment. However, over the last decade, significant advances have been made in scaling up CFBC units and in the adoption of supercritical (SC) steam cycles."

Giglio noted: "It's always a case of the incumbent wanting to stay with what they know. So it's a case of educating, and getting the message out that there is another option. And while it has not been demonstrated in India on these 500+ MW coal plants, it has been demonstrated in other parts of the world."

SFW's CFB technology has been proven at increasing sizes for a number of years, achieving the 200 MW utility size in the 1990s. Today, SFW has single unit CFB designs up to 800 MWe capacities with advanced vertical tube supercritical steam technology.

Supercritical steam conditions represent a physical point just above the vapour/liquid equilibrium phase of water. When the steam pressure reaches above the critical pressure of 221.2 bar two-phase mixtures of water and steam cease to exist, and as the temperature of the water rises above 374°C the water behaves as a single supercritical fluid, allowing the fluid to absorb much more heat resulting in significantly improved overall power plant efficiency.

The technology advance to once-through supercritical (OTSC) units was first demonstrated at the 460 MWe Łagisza plant in Poland, which entered commercial operation in 2009. Since its startup, the plant has operated on a range of Polish bituminous coals and has demonstrated a

Giglio says India's domestic coal is ideal for CFBs

The technology advance to once-through supercritical (OTSC) units was first demonstrated at the 460 MWe Łagisza plant in Poland

Samcheok design steam parameters at 100 % load

SH steam flow (kg/s)	437.7
SH steam pressure (bar[g])	257
SH steam temperature (°C)	603
RH steam flow (kg/s)	356.4
RH steam pressure (bar[g])	53
RH steam temperature (°C)	603
Feed water temperature (°C)	297

LHV net plant electrical efficiency of 43.3 per cent. Then in 2016 SFW completed the Novocherkasskaya GRES No. 9 supercritical CFB project in Russia. This 330 MWe CFB unit, which is the first of its kind in the country, is capable of combusting a wide selection of fuels including anthracite, bituminous coal and coal slurry.

Notably, SFW took the next evolutionary step in the design and scale-up of its CFB boilers at the Samcheok Green Power Plant in South Korea, owned by Korea Southern Power Company (KOSPO). These are the most advanced supercritical circulating fluidised bed boilers in the world, capable of co-firing a wide range of coals with biomass.

Each boiler at Samcheok is designed to produce main steam at a temperature of 603°C and reheat steam at 603°C. Superheat steam pressure is 257 bar [g]. The once-through ultra-supercritical (OTUSC) CFB boilers utilise advanced vertical tube low mass flux Benson evaporator technology, which is more efficient and easier to build and maintain than conventional spiral-wound supercritical boiler technology.

The vertical tube design has several advantages over a spiral tube design. It has a lower pressure drop across the boiler, resulting in higher efficiency. Samcheok has a net electrical efficiency of more than 42 per cent (LHV) compared to the 38-39 per cent typically achieved with traditional boilers.

SFW says that out of the hundreds of boilers sold in the market, only a few use this relatively unique technology.

Under a contract awarded in 2011, SFW designed and supplied four 550 MWe (gross) ultra-supercritical boilers producing steam at 600°C for the first phase of the project. The first phase (Units 1 and 2) are configured as two blocks with each block having two boilers feeding into a single 1100 MW steam turbine.

An important aspect of the project is its ability to burn low quality international coal that is 20-30 per cent cheaper than premium quality coal. For a plant as large as Samcheok's phase I, this fuel discount works out to be a considerable amount in plant operating cost savings, considering that the fuel cost is around 70 per cent of a power plant's total running cost.

The boilers are expected to burn about 5 per cent biomass in terms of heat input, depending on availability. This is likely to be in the form of recycled wood waste from the local lumber industry and imported wood pellets. The plant's environmental performance will be further improved as more biomass is introduced to the mix.

In the first years of operation, the Samcheok CFB plant has been firing mainly Indonesian coals and domestic biomass. KOSPO has begun exploring other fuel sources by test firing US and Russian coals. SFW says the plant's full fuel flexibility potential will be realised over time

According to SFW, environmental performance on these low rank coals has also been "excellent", meeting the design limits. NOx and SOx emissions are each guaranteed at 50 ppm (at 6 per cent O_2). Dust emissions are controlled by an electrostatic precipitator, so that particulates do not exceed 20 mg/Nm^3. Carbon dioxide emissions are around 800 g/kWh, which is about 25 per cent below a typical coal fired plant in Korea.

Unit 1 has been operating successfully since late 2016 and Unit 2 since June 2017. Samcheok is a good reference for India, as such units are in the right size range and efficiency for the Indian market.

"Most of the plants that come online are increasingly supercritical units," said Krishnan. "And if you look at the projects that are on the drawing board at this point, many of them are in the 500-660 MW range."

The size of the opportunity in India, however, is a function of how fast the economy grows. As Krishnan notes: "If it grows at 9-10 per cent, the need for new capacity becomes more critical. And if it grows at 7 or 8 per cent, it is essential but not as much. Another factor is the ageing of India's coal fired fleet as a number of plants approach their end of life requiring new capacity additions. So we are looking at between 10 000-20 000 MW per year in additional capacity, and a lot of that is going to be coal fired. Perhaps 20-30 per cent will be renewables and hydro and 70-80 per cent will be coal fired.

"Renewables, especially solar, are making inroads into the Indian market but the country needs base load power, and renewables in India are still unreliable and expensive in many parts of the country. With the abundance of local coal that is available in India, it is very much at the forefront of all the fuels. And SFW is the only one with supercritical CFB units in the size range that India is demanding."

There is no doubt that CFB technology is now at the point where it matches the demands of the Indian market much better than in the past. As Giglio summarised: "In the past it was not about the fact that the CFBs could meet the emission limits without the backend equipment, because the emission limits didn't exist before. So the default choice was PC. Now that's been disrupted because they now have to control the emissions from these plants. The Indian market is now at the point where it sees the value of the CFB."

SFW took the next evolutionary step in the design and scale-up of its CFB boilers at the Samcheok Green Power Plant in South Korea

A GIANT LEAP FOR
CLEAN AND
FLEXIBLE POWER

The massive 2.2 GWe Samcheok Green Power Project in South Korea is approaching two years of full commercial operation. Utilizing the most advanced ultra-supercritical CFBs in the world, it signifies the next big step for clean and flexible power from economical solid fuels.

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Egypt sets grid up for the future

■ Siemens, EETC set for grid studies ■ World Bank backs Lekela wind farm

Siân Crampsie

Egypt is seeking advice and analysis of its electricity grid as the country expands its generating capacity.

The Egyptian Electricity Transmission Company (EETC) has awarded Siemens a series of five-year grid studies to identify and analyse the feasibility of deploying different advanced energy technologies and identify the challenges it faces.

The move comes as Egypt's installed generating capacity reached 55 GW, making it the largest electricity generating system on the African continent. Egypt has added almost 25.5 GW to the grid since 2014, according to Minister of Electricity and Renewable Energy, Mohammed Shaker.

EETC and Siemens will study the potential role of smart technologies to transform the grid, as the country changes the way energy is generated, distributed, managed and stored. To ensure know-how transfer and local capacity building, the study will include a comprehensive training programme for the EETC planning team who will jointly execute the various studies together with Siemens.

"Digital grids will play a key role in the country's transition to a sustainable energy system through facilitating smooth integration of new and different energy sources. This will enable the growth of distributed generation and its potential incorporation into the main grid, providing flexibility and visibility of the entire grid," said Ehab Fawzi, Senior Vice President for Siemens Digital Grid in Egypt.

The Siemens-EETC cooperation will also explore the opportunities and challenges facing the national grid, with Egypt's plans to leverage electric mobility and the expansion in new energy projects such as the 1800 MW Benban solar park, the Egypt-Sudan interconnection project and the Ouynat East development project.

The majority of Egypt's power generation capacity – 85 per cent – is natural gas-based, but renewables capacity is also growing. Last month the World Bank signed an agreement to support development of a 252 MW wind farm being developed by Lekela in the Red Sea governorate.

Under the financing deal, IFC will provide $84 million in financing while MIGA will offer $122 million in financial guarantees. The wind farm, West Bakr, located in the Gulf of Suez, is expected to produce over 1000 GWh per year, at a tariff well below the average cost of generation in Egypt. It is part of the government's Build, Own, Operate framework and a key pillar of targets to generate 20 per cent of electricity from renewable energy sources by 2022, reducing Egypt's reliance on natural gas.

Dhofar wind on-line

Oman's first utility-scale wind farm is set to start full commercial operations later this year.

The Dhofar wind farm generated first power last month, the country's Rural Areas Electricity Company (Tanweer) said in a statement, adding that commercial operation would start "in the coming months".

The 50 MW project will be equipped with 13 GE wind turbines and was developed by Abu Dhabi-based renewable energy major Masdar and financed by the Abu Dhabi Fund for Development (ADFD). When completed, the wind farm will account for 7 per cent of Dhofar Governorate's total power demand.

The output will be sold to Oman Power and Water Procurement Company (OPWP). Tanweer will oversee operation and management of the farm, which is also the first large-scale wind project in the Arabian Gulf region.

The Oman Power and Water Procurement Company (OPWP) – the sole off-taker of output from power generation and water desalination projects – plans to procure at least 2200 MW of renewables based electricity capacity by 2025 within the Main Interconnected System (MIS), serving the northern half of the Sultanate. Smaller wind-based schemes are envisioned in the Sharqiyah, Al Duqm and Dhofar zones.

According to its recently released seven-year statement, OPWP plans to re-tender for a Wind Resource Assessment (WRA) campaign this year. "OPWP plans to develop wind energy projects in tenders of 100-200 MW, subject to market assessment and site suitability," OPWP said. It added that developing a utility-scale wind energy project in Al Wusta governorate will also depend on having electricity transmission access to the MIS demand area. A new 400 kV transmission line from Izki to Duqm is expected to be completed in 2023.

Power shortages ease in Zimbabwe

Zimbabwe's electricity supply shortages have eased after negotiations with South Africa enabled the resumption of supplies.

The Zimbabwean government last month stepped in to make a payment of $10 million to South African utility Eskom and tie national utility Zesa to a payment schedule to repay the remaining debt of $28 million owed.

The deal enabled electricity to once again start flowing to Zimbabwe from South Africa to ease the crippling 18-hour per day power cuts that have been imposed.

Zesa said that it would be able to downgrade load-shedding from stage two to stage one as a result, cutting off power during peak periods from 5am to 10am in the morning and 5pm and 10pm in the evening.

According to local media reports, Zesa will have to pay Eskom $890 000 per week under the payment schedule. The utility is also hoping to boost supplies from Mozambique's Hydro-Cabora Bassa.

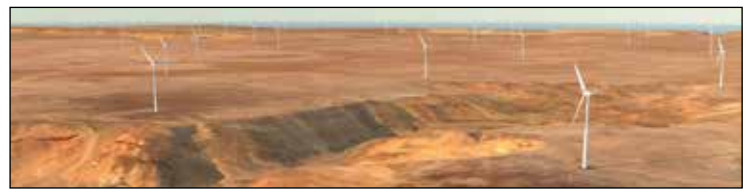
Power generation capacity in Zimbabwe has dropped due to drought, which has brought water levels at the Kariba dam to record low levels, and dilapidated infrastructure at the Hwange and other thermal power plants.

Kariba has lost 700-800 MW of its 1050 MW output and is in danger of being shut down if water levels continue to drop, according to reports. Eskom is providing Zimbabwe with 400 MW, leaving a 400 MW deficit for Zesa to manage through load shedding.

Zimbabwe is making efforts to boost power generating capacity. The Zimbabwe Power Company (ZPC) is expanding the Hwange power plant and says that work on the two new units at the site is 18 per cent complete. The 600 MW expansion project is due to be completed in 2022.

Meanwhile Matshela Energy has been awarded a licence to build a 100 MW solar plant and says that the $250 million project could start generating electricity within 12 months.

Dumat Al Jandal sets record low



Saudia Arabia has achieved the world's most competitive price for onshore wind energy generation with the cost of electricity production from the Dumat Al Jandal wind farm set at 1.99 cents / kWh.

Saudi Arabia's Ministry of Energy, Industry and Mineral Resources said that the price achieved at the 400 MW project reflected the confidence of local and international investors in the Kingdom's potential for renewable energy development.

The wind farm will be the first utility-scale wind farm in Saudi Arabia and the largest project of its kind in the Middle East. A consortium led by EDF Renewables and Masdar completed financial close for the project last month.

The wind farm will supply electricity under a 20-year power purchase agreement (PPA) with the Saudi Procurement Company, a subsidiary of Saudi Electricity Company (SEC). It will be located around 900 km north of Riyadh, in the Al-Jouf region of Saudi Arabia.

Construction is expected to begin shortly and commercial operation is scheduled for the first quarter of 2022. Vestas will supply the wind turbines for the project and will be responsible for engineering, procurement and construction.

TSK, a Spanish industrial group, will be responsible for the balance of plant, while CG Holdings will be responsible for the substations and high-voltage solutions.

Kenya puts Olkaria V on line

Completion of a new geothermal power plant has enabled Kenya to add 79 MW of capacity to its grid, according to the Kenya Electricity Generating Company (KenGen).

Unit 1 of the Olkaria V geothermal power plant was first synchronised to the grid on 28 June 2019 and is now undergoing commissioning tests. KenGen's installed geothermal capacity now stands at 612 MW, the utility said.

Now in its final stages of development, the Olkaria V power plant is expected to inject a total of 158 MW to the grid once Unit 2 is synchronised to the grid at the end of August.

The project is a key part of Kenya's Big Four Agenda and the Vision 2030 development blueprint.

■ The European Reconstruction and Development Bank (EBRD), Asian Infrastructure Investment Bank (AIIB) and Black Sea Trade and Development Bank (BSTDB) are helping Turkey diversify its energy mix with an investment of $350 million in a 100 MW geothermal power plant. Efeler will be located in western Turkey and will be developed by Gürmat Elektrik, a renewable energy subsidiary of Güris Holding.

Ovo sets sights on SSE deal

■ SSE confirms talks ■ Deal would add 5.7 million customers to Ovo books

Siân Crampsie

UK energy company Ovo would become the second-largest supplier of electricity and gas in the UK if it succeeds in sealing a deal to buy SSE Energy Services.

SSE has been looking for a buyer for its domestic energy sales business for several months and confirmed in August that it is in talks with Ovo, one of its smaller rivals and a relative newcomer to the UK's energy supply market.

"SSE plc can confirm it is in discussions with Ovo Group over the possible sale of the SSE Energy Services business, which supplies energy and related services to around 5.7 million household customers across Great Britain," SSE said in a statement.

"These discussions are continuing, however no final decisions have been taken and no agreements regarding the terms of any transaction have been entered into.

"The Board remains focused on securing the best long-term future for the business, its customers and employees, and for shareholders."

SSE began looking for a buyer for the domestic energy business after a proposed deal to combine it with Npower, the UK retail unit of Germany's Innogy, fell apart at the end of 2018. It has also examined an option to hive off and float the unit as a standalone business.

The sale of its domestic retail unit will enable SSE to focus on renewable energy generation and regulated network assets, SSE says.

Ovo was launched in 2009 and has a market share of five per cent, serving 1.5 million customers across Great Britain. The purchase of the SSE retail unit would increase its market share to 18 per cent, just behind Centrica-owned British Gas, with 19 per cent.

Last year Ovo announced an investment in German start-up energy supplier, 4hundred, marking a move into Europe's energy markets. It has also been investing in technology such as vehicle-to-grid.

Energy Vault takes leap forward

Energy Vault says that a $110 million investment from SoftBank Vision Fund will enable it to accelerate global deployment of its novel energy storage technology.

The Switzerland-based tech firm has developed a novel gravity-based energy storage system that uses giant bricks. It will use the funding to pursue a rapid global deployment strategy, simultaneously building commercial-scale projects on four continents, it said.

The funding marks the first investment by SoftBank Vision Fund 1 has invested in energy storage. Andreas Hansson, Partner for SoftBank Investment Advisers, will join the Energy Vault board of directors as part of the Series B deal, the companies said.

Energy Vault's long-duration energy storage technology uses a crane to lift bricks into a tower formation when there is excess power in the grid, for example from wind or solar. When power is needed, the crane lowers the bricks back down to the ground using the force of gravity to generate electricity. The movement of the blocks is controlled autonomously by software that responds to changes in power availability in the electrical grid – storing up energy when electricity is abundant and creating electricity when needed.

The energy towers can be a cost-efficient way of storing power, because the huge 35 tonne bricks can be constructed from local materials such as compressed soil combined with a special sealant.

The system is designed to enable renewables to provide baseload power 24 hours a day at low cost. Most energy storage systems being deployed around the world today are based on short-duration battery technologies or pumped hydro storage. Respectively, these are too expensive and too geographically limited to be deployed on a large scale.

"Energy Vault solves a long-standing and complex problem of how to store renewable energy at scale," said Akshay Naheta, Managing Partner for SoftBank Investment Advisers. "The company's integration of proven technologies with 21st century material science and machine vision software provides a solution that reshapes the unit economics of renewable energy while being restorative to the environment. Energy Vault is highly complementary to SoftBank's existing energy portfolio and we are pleased to further the company's global development."

"As we pursue our mission to enable renewable energy to replace fossil fuels 24 hours a day, we're thrilled to partner with SoftBank Vision Fund as we expand our global presence," said Robert Piconi, Chief Executive Officer and Co-Founder, Energy Vault. "The Vision Fund shares our passion to combat climate change through innovation in energy storage technologies and, with its support as a strategic partner, Energy Vault is well positioned to meet the large and currently unmet demand for sustainable and economical energy storage worldwide."

Energy Vault is planning a test phase with India's Tata Power Company, and has also signed an agreement to demonstrate the first 35 MWh storage tower in the north of Italy in 2019. It has a one-quarter-scale pilot tower in Switzerland that became operational last year.

Wood offloads nuclear unit

Wood Group has reached an agreement to sell its nuclear energy business to Jacobs as part of plans to cut debt levels.

The UK engineering and energy services company will raise $250 million from the sale, which is subject to clearance from competition authorities.

The move to sell the business – which designs and maintains nuclear assets – follows Wood Group's 2017 purchase of Amec Foster Wheeler for £2.2 billion. That deal enabled Wood Group to diversify away from its traditional oil and gas business sectors, but saddled it with debt.

In March 2019, Wood said it would sell $200-300 million worth of assets. It disposed of its TNT materials handling business in May for $41 million. The sale of the nuclear business to USA-based Jacobs is expected to cut debt to close to its target of 1.5 times earnings before interest, tax, depreciation and amortisation (EBITDA).

David Kemp, Wood's Chief Financial Officer, said: "The sale of our nuclear business follows other recent divestments and marks a significant step towards achieving Wood's target leverage policy. Although our nuclear business is a strong UK player and has performed well, we see better opportunities to develop clear global leadership positions across other parts of our business."

The Wood Group's nuclear business designs, delivers and maintains strategic and complex nuclear assets for customers primarily in the UK. In 2018, the profit before tax for the year amounted to $14.2 million and gross assets at year-end amounted to $464 million.

After the purchase of Amec Foster Wheeler, Wood's net debt rose to $2 billion, or 2.4 times EBITDA. The company reduced debt to $1.5 billion by the end of 2018. The sale's "cash proceeds … will be used to reduce debt and will enable Wood to take a significant step towards achieving its target leverage policy", the company said in a statement.

Senvion restructures India unit

Floating offshore solar photovoltaic (PV) farms could be the next step in offshore renewable energy technology, according to a new international consortium.

Tractebel, Jan De Nul Group, DEME, Soltech and Ghent University have joined forces to investigate the feasibility of and opportunities for offshore solar technology. They believe that offshore solar farms, co-located with offshore wind energy and other offshore resources, such as aquaculture, is the next logical step in the energy sector.

The companies will develop new concepts and perform laboratory and field testing to take the first steps towards the commercialisation of offshore PV technology. The €2 million has been set up in the framework of the Flemish Blue Cluster and is led by Tractebel.

According to the partners, development of offshore PV technology is a natural step after floating PV farms on lakes, lagoons and other sheltered environments. Factors such as land scarcity, large scale standardisation and "not in my backyard", or NIMBY, thinking impact could also drive the uptake of offshore PV, they said in a statement.

Their ambition is also to be the first to realise offshore solar farms in the Belgian North Sea. One of their main challenges will be to adapt solar PV technology for the rough offshore environment so that it is able to withstand salt water, waves and strong currents.

A cost-competitive concept for a floating structure needs to be designed, while ecosystem integration of the floating PV panels will be investigated from the start, the partners say.

Americas

Voith signs Los Lagos contract

Statkraft Chile has selected Voith as a partner in its Los Lagos hydropower construction project.

The Los Lagos project will be equipped with a Kaplan turbine with a rated output of approximately 52 MW, and is expected to generate 260 GWh per year.

Voith will supply the full scope of electromechanical and hydromechanical equipment, in addition to providing engineering services during the plant's erection and assembly, including project management and supervision. All components required will be produced at Voith's manufacturing facilities in the city of São Paulo, Brazil.

The facility will be installed on the Pilmaiquén River, downstream from Rucatayo, another hydropower plant owned by the Statkraft. The power plant's construction works are scheduled to begin in August this year, while completion is expected for the second half of 2022.

The contract for the construction works was awarded to a local consortium consisting of three construction companies: Brotec, Valko and ObeChile.

IEA plans for Milligan 1

EDF Renewables North America has awarded Infrastructure and Energy Alternatives, Inc. (IEA) a contract valued at approximately $98 million for construction of the Milligan 1 wind farm in Saline County, southeast Nebraska, USA.

The 300 MW Milligan 1 wind farm will use a combination of Vestas V110, Siemens 129 and Siemens 145 turbines. The scope of IEA's work on the project includes engineering and construction of the turbine foundations, turbine access roads, MV collection system, wind turbine installation and construction of the on-site operations and maintenance building.

Work on the Milligan 1 project is scheduled to begin in September with full operation by November 2020.

Ansaldo wins Irsching OCGT contract

Ansaldo Energia has been awarded a turnkey engineering, procurement and construction (EPC) contract for the design, supply and installation of a 300 MW open-cycle gas turbine (OCGT) power plant in Irsching, in southern Bavaria, Germany.

The Irsching 6 power plant will be equipped with an AE94.3A gas turbine, generator and auxiliary systems. The plant is part of the German TSO project 'besonderes netztechnisches Betriebsmittel – bnBm' (network reserve project) which includes tenders in four areas of southern Germany.

Energy firm Uniper is developing the plant, which will be operational by October 2022.

GE flexes upgrade at Magnolia

GE has received its first order for a 7F DLN2.6+ Flex upgrade solution.

The tech firm will apply the upgrade at the Southern California Public Power Authority's (SCPPA) Magnolia power plant in Burbank, California. The upgrade will help the plant to significantly improve its ramp rate and increase its operational flexibility, with a lower load operation profile to respond faster to the frequent shifts in grid demand due to renewable power fluctuations.

Leveraging GE's DLN 2.6+ combustor and combining it with GE's proven Axial Fuel Staging (AFS) technology, the Flex solution is a comprehensive upgrade within GE's suite of offerings for 7F gas turbines. It normally has approximately 20 percentage points lower turndown capabilities and reduces minimum load fuel burn by up to 25 per cent.

At Magnolia, the solution is expected to deliver greater benefits by decreasing turndown and emissions by over 25 percentage points. The upgrade will be installed on GE's 7F.03 unit at Magnolia plant in the first quarter of next year.

Prysmian bags Hollandse Kust Zuid order

Vattenfall has placed an order with cable firm Prysmian to provide the submarine inter-array cable systems for the Hollandse Kust Zuid III and IV offshore wind farms in the Netherlands.

The award follows Vattenfall's successful bid for the permit to develop these wind farms on a subsidy-free basis. Prysmian will design, test and supply 172 km of 66 kV XLPE-insulated inter-array cables, as well as the related accessories, with delivery due by 2022.

The three wind farms will have a combined capacity of 750 MW.

CDI closes Oyster Creek deal

SNC-Lavalin and Holtec International joint venture, Comprehensive Decommissioning International (CDI), has been awarded its first commercial contract, worth hundreds of millions of dollars, to decommission the Oyster Creek nuclear power plant in New Jersey, USA.

CDI aims to safely and efficiently decommission and dismantle the site in less than 10 years using innovative technologies. "This is just the beginning of what we know is a bright future for CDI in reactor decommissioning, and a great example of the services-based contracts CDI can undertake," said Sandy Taylor, President, Nuclear, SNC-Lavalin.

The US Nuclear Regulatory Commission (NRC) approved the transfer of the Oyster Creek licence from Exelon to Holtec in June 2019 and plant ownership was transferred on July 1. Agreements are also in place between Holtec and Entergy for its US Indian Point, NY, Palisades, MI, and Pilgrim, MA, nuclear units, in which CDI will be the Decommissioning General Contractor, following each plant's closure.

Asia-Pacific

SGRE secures India win

Siemens Gamesa Renewable Energy (SGRE) has secured its first order in India with Alfanar for the supply of 206 units of the SG 2.2-122 wind turbines for two wind farms, totalling 453 MW.

The two wind farms will be located in Bhuj, Gujarat and are expected to be commissioned by 2020. One will have a capacity of 202 MW and the other 251 MW.

Jamal Wadi, CEO, Alfanar Global Development, said: "As one of the global players for developing renewable projects, we are happy to partner with Siemens Gamesa yet again, this time for part of our 600 MW portfolio awarded under the SECI bids, which we are developing in Bhuj, India. With more than 3 GW of greenfield development in the pipeline for Alfanar in India, our main goal is to provide value and benefit to the community by partnering with reliable manufacturers."

Pöyry wins Malaysia assignment

Scatec Solar subsidiary Redsol Sdn Bhd has awarded Pöyry the Owner's Engineer contract for a 30 MWp solar photovoltaic (PV) development in Malaysia.

The contract is Pöyry's third Owner's Engineer contract in Malaysia for a solar project. Its services include assistance in project management, engineering review, as-built drawing review, and other assistance during project construction.

The solar PV plant, located in Perak, Malaysia, will be the fourth project of its kind owned by Scater Solar in Malaysia.

ABB supports Chinese CSP growth

ABB is to deliver the automation control solutions for China's first two concentrated solar power (CSP) plants.

Building on the successful delivery of power at the first 50 MW CSP in Delingha with China General Nuclear Power Group in late 2018, ABB has been awarded a second contract to deliver an integrated automation solution for the 100 MW Urat solar energy project in Inner Mongolia province, China.

"We are delighted to have been awarded a second project to deliver our digital solutions as part of the 20 pilot CSP solar programme, aimed at boosting China's efforts to meet the 2030 target of producing 20 per cent of its overall electricity from renewable sources," said Kevin Kosisko, Managing Director, Energy Industries, ABB.

The plant is the first of its kind in Inner Mongolia, and at 500 ha, is one of the largest capacity solar parabolic projects in China's 20 pilot plant initiative.

Europe

Jan De Nul bags Kriegers Flak contract

Jan De Nul Group has signed a contract with Vattenfall Vindkraft Kriegers Flak P/S for the transport and installation of 72 Siemens 8 MW wind turbines for the Kriegers Flak offshore wind farm in Denmark.

Kriegers Flak is located in the Baltic Sea in water depths varying between 15 and 30 m, 15 km from shore. Installation works will start in the first quarter of 2021 and will take four months.

Nordex notches Spain success

Alfanar Group has placed orders with Nordex for the supply and installation of 22 wind turbines for two wind farms with a total capacity of 67.2 MW.

The two wind farms are to be built in the province of Albacete in Castilla-La Mancha, 300 km to the southeast of Madrid. The Barrax wind farm will include ten AW140/3000 and three AW132/3300 turbines. For the Chinchilla wind farm, Nordex will provide eight AW140/3000 machines and one AW132/3300 turbine.

The turbines will be installed on concrete towers with a hub height of 120 m, with delivery scheduled for the second half of 2020. Both orders include full service for a period of 20 years.

Stadtwerke München resets clock on GTs

GE has announced that it will provide its 9EMax gas turbine upgrade solution to the German power producer, Stadtwerke München (SWM), for the utility's cogeneration plant in Munich, Germany.

SWM's Heizkraftwerk-Süd (HKW-Süd) plant produces thermal energy for district heating for the industry and residential users, and is an important component of Munich's energy supply. Modernizing its two GE 9E.03 gas turbines and two A39 generators is expected to increase power output by approximately 15 MW per unit and improve the efficiency of each gas turbine by up to 3 per cent.

When completed in 2020, SWM expects the upgrade to reduce nitrous oxide emissions significantly and also decrease carbon dioxide (CO_2) emissions.

"SWM's district heating network extends approximately 800 km and provides heat and hot water for a third of the households in Munich," said Helge-Uve Braun, Technical Managing Director of SWM. "In the long term, we want to generate CO_2-neutral district heating in Munich, primarily using geothermal energy. Until then, we are working on optimising our existing conventional plants and continuing to operate them as environmentally friendly as possible."

Subsea 7 wins at Hornsea Two

Seaway 7, a unit of Subsea 7, has won a contract for the installation of the inter-array grid cable system at the Hornsea Project Two offshore wind farm in the UK.

In addition to the submarine cable installation works, Seaway 7 will undertake a pre-installation submarine cable route survey, perform pre-installation boulder clearance activities and execute post-lay trenching services.

Hornsea Project Two is located some 90km off the Yorkshire coast and will comprise 165 Siemens Gamesa 8 MW turbines.

According to the company, the inter-array grid cable system consists of 165 66 kV copper-core submarine composite cables with a total length of more than 420 km.

Project engineering will commence immediately, with offshore activities due to commence in 2021.

JDR Cables is in charge of the design and manufacture of 100 km of inter-array cables, with Prysmian supplying over 300 km of the 66 kV cables.

International

CG Power wins Saudi contract

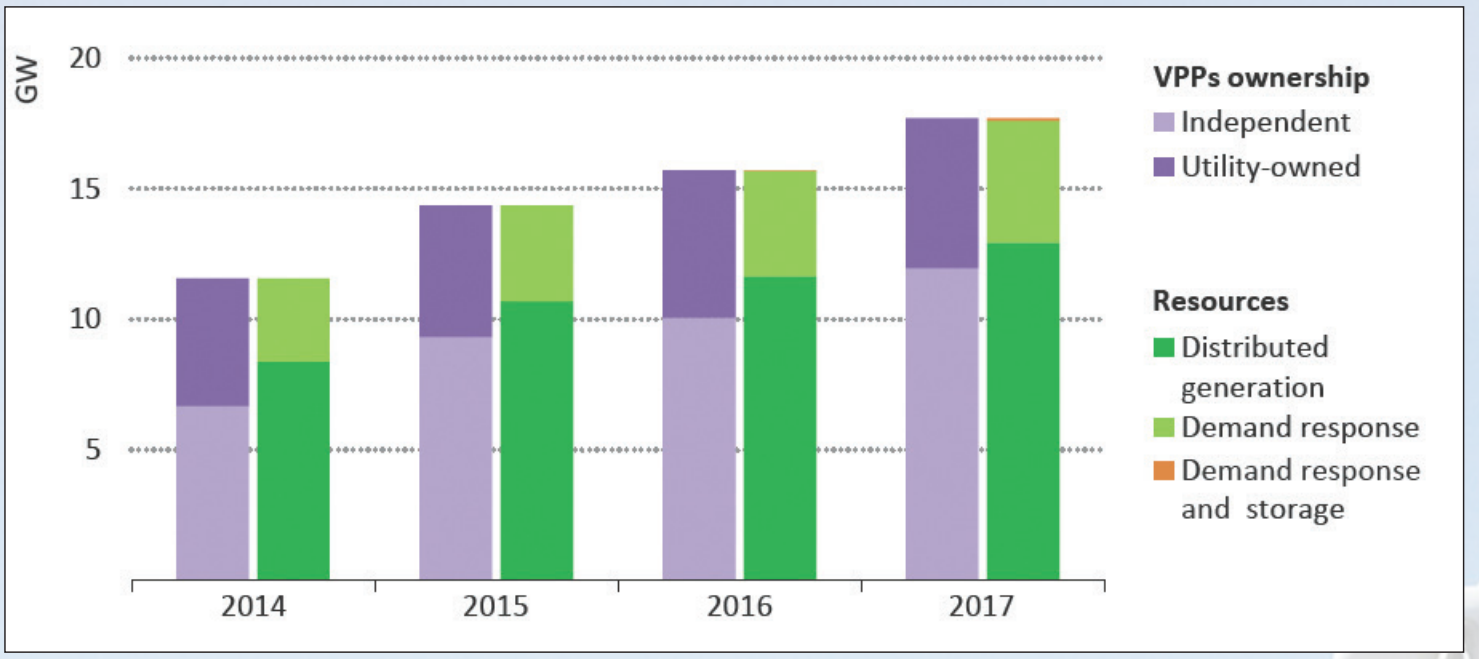
CG Power & Industrial Solutions has won a contract to design and build high voltage substations for the 400 MW Dumat Al Jandal wind farm project in Saudi Arabia.

Located some 900 km from north of Riyadh, in Al Jouf region, the $14 million Dumat Al Jandal wind farm will be Saudi Arabia's first large-scale onshore wind farm and the largest so far in the Middle East.

The award was given to CG Power's subsidiary, CG Holdings Belgium NV Systems Division by the project's developer, a consortium of EDF Renewables and Abu Dhabi Future Energy Company (Masdar).

The consortium was awarded the project by Saudi Arabia's Renewable Energy Project Development Office (Repdo), part of the Saudi Arabian Ministry of Energy, Industry, and Mineral Resources, in January 2019. It will supply power to the Saudi Power Procurement Company, a subsidiary of Saudi Electricity Company (SEC).

Virtual power plants in the European Union



World Energy Investment 2018, © IEA/OECD, Figure 7.22 , page 305

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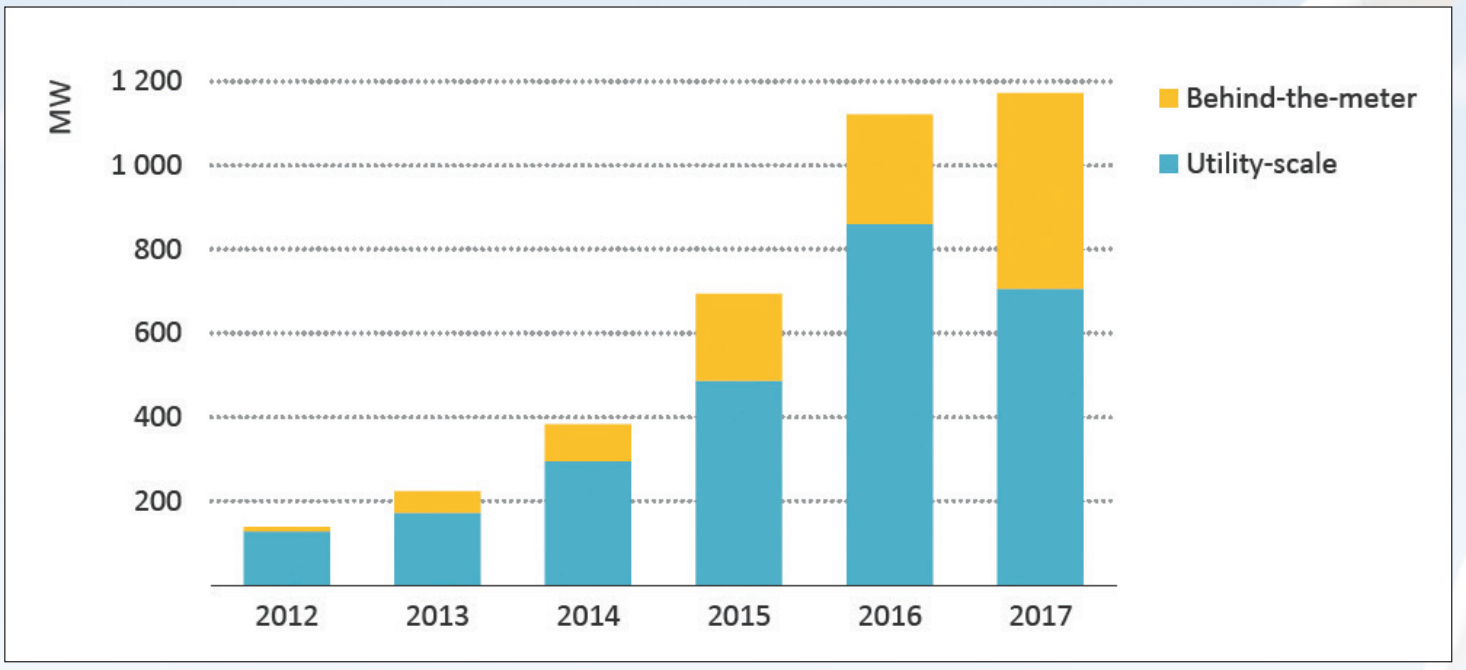
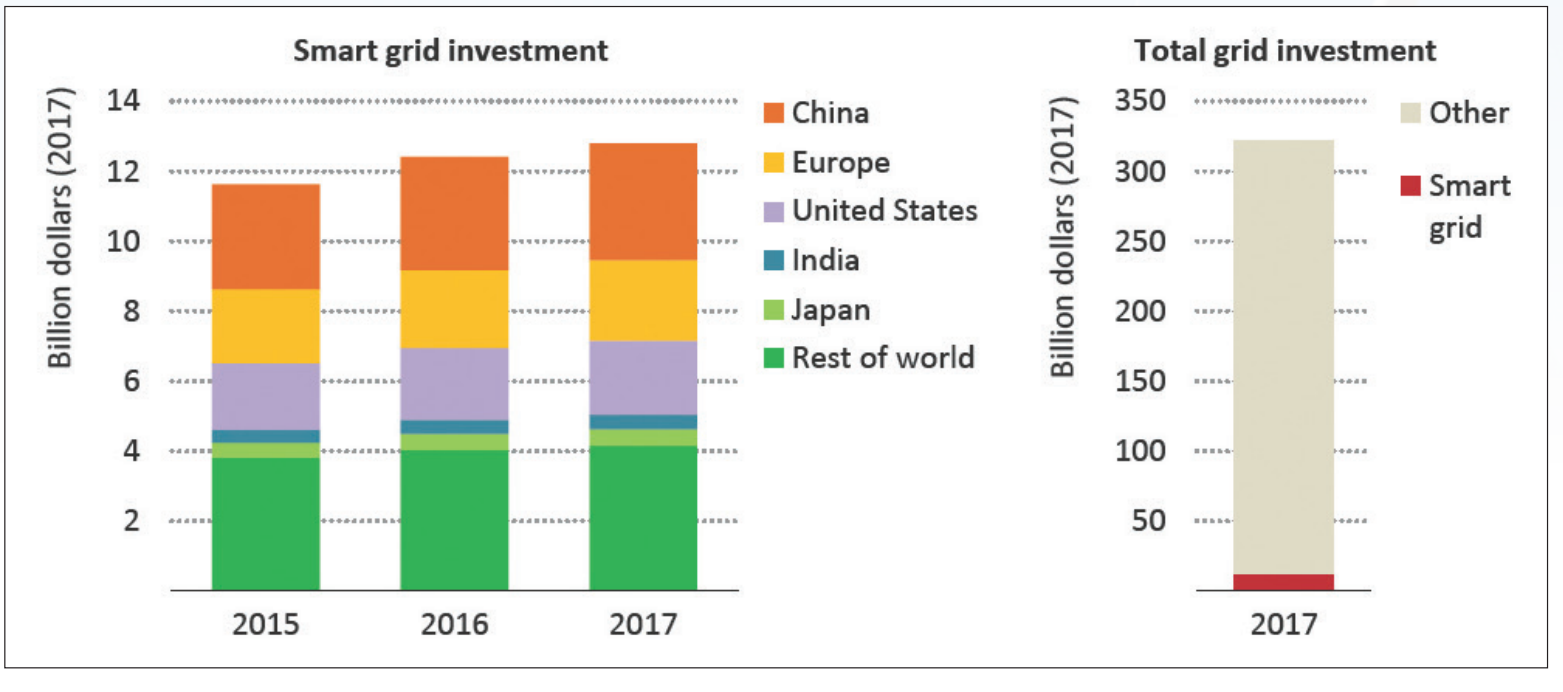
Annual additions of behind-the-meter and utility-scale battery storage, 2012-2017



World Energy Investment 2018, © IEA/OECD, Figure 7.23, page 306

Investing in smart distribution grids, 2015-2017

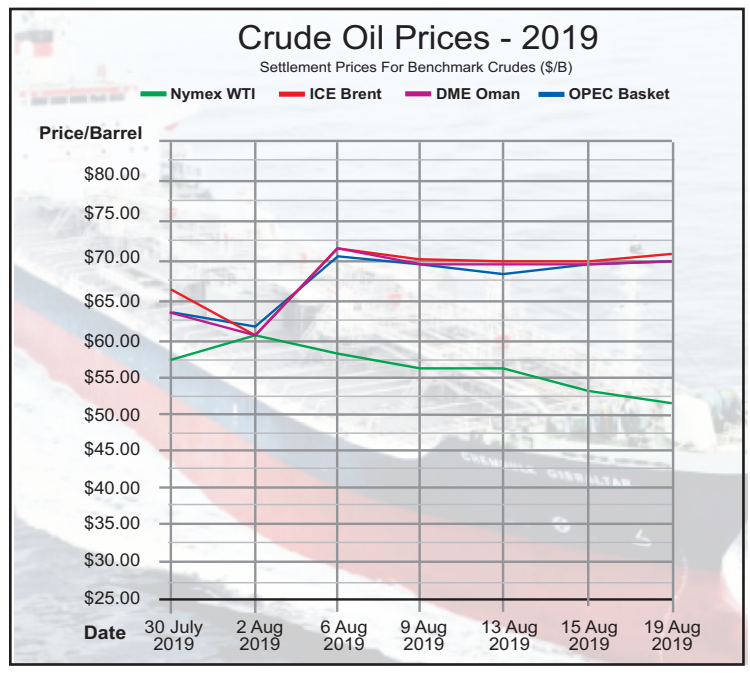


World Energy Investment 2018, © IEA/OECD, Figure 7.24, page 307

Source: World Energy Investment 2018

Oil

US to become oil production giant in time of climate crisis



- US oil and gas production to increase by 25 per cent
- Oil demand outlook "fragile"

Mark Goetz

As Opec and its allies struggle with declining demand for oil on the global market and cope with indicators that suggest that world economic growth is slipping and that the trade war between the US and China is only complicating efforts to keep that fragile supply/demand scale in balance, a new report from international human rights and anti-corruption foundation Global Witness says that mounting oil production in the US could lead to the world being literally drowned in oil by the end of the next decade.

According to the report released in mid-August, the US over the next decade (2020-2029) will account for 61 per cent of all new oil and gas production and that total US oil and gas production will increase by 25 per cent during that time, the report says, using data acquired from Rystad Energy.

"New US oil and production will be eight times the forecast output of the next largest producing country, Canada, 20 times that of Russia, and more than 40 times the output from new fields in Saudi Arabia," the report says, adding: "Production from new fields in the US in 2029 is set to be greater than the current output of all oil and gas fields in Saudi Arabia."

The indicators are pointing that way. US production during 2019 will average 12.3 million b/d, according to the latest monthly report issued by the US Energy Information Administration (EIA), which forecast 2020 oil production averaging 13.3 million b/d. Both will be record levels the EIA said.

Once the powerhouse of crude oil and master of the market, Opec continues to restrict production yet and sees a surplus in the market in the months ahead. The latest monthly Opec report suggests that more production cuts might be necessary. This however does not worry producers like the US, which are going hell for leather to boost output, for example: the EIA has forecast that US shale oil production alone in September will reach 8.77 million b/d, up by 85 000 b/d from August.

In mid-August, crude oil prices were well below the $75/b that Opec has claimed as a 'fair' price in the past. West Texas Intermediate (WTI) was in the $56/b range and Brent crude was below $60/b. The production cut that Saudi-led Opec and its non-Opec ally Russia implemented in January of this year – a reduction of 1.2 million b/d – will remain in place until March 2020. Perhaps by then the US-China trade war will be over and growth in demand in China will resume, but that will depend on the state of the Chinese economy at the time.

The Opec report forecast that demand for Opec crude will average 29.41 million during 2020, down by 1.3 million bpd from this year. "The risk to global economic growth remains skewed to the downside," the report said. "Especially trade-related developments will need to be thoroughly reviewed in the coming weeks with some likelihood of a further downward revision in September," it added.

The Paris-based International Energy Agency (IEA) sees a bearish future for growth in oil demand too in its August report. While geopolitics in the Middle East and the US-China trade imbroglio factor are ongoing concerns, the IEA said it had sharply cut back its demand growth estimates. "For the OECD as a whole, demand has fallen for three successive quarters," it said, adding that for this latest report, it had revised growth estimates down for 2019 and 2020 to 1.1 million b/d and 1.3 million b/d, respectively. Global oil demand for 2019 is estimated at 100.4 million b/d by the IEA. "The outlook is fragile with greater likelihood of a downward revision than an upward one," the report said.

Judging by the Opec and IEA reports, the world is pretty close to having all the oil it needs already. If the situation forecast by Global Witness actually materialises, what will the world do with all that oil? Especially at a time when using less oil is the idea many economists, environmentalists, renewable energy companies, and concerned consumers are working for as our climate crisis becomes more obvious.

"Global oil and gas production needs to begin an immediate and rapid decline if the world is to achieve the goal of the Paris climate agreement to limit global warming to 1.5 degrees centigrade," the Global Witness report says. It calls for an end to fossil fuel subsidies in the US that cost taxpayers $4.6 billion annually, saying that up to half of new US oil fields rely on government subsidies to be economically viable.

Furthermore, one media report cited data from Rystad Energy that said the global oil industry would sanction offshore oil projects this year worth $123 billion.

Is it rhetorical to ask why such huge investments aren't instead directed towards renewables and other alternative forms of energy for the sake of reducing carbon emissions into the atmosphere?

Gas

US LNG industry makes strides in August

With several export facilities set to come on stream, it begs the question about where all of this LNG will go.

David Gregory

Several major steps were made by the US LNG industry during August, indicating what can be expected in the future as more liquefaction export facilities come on-stream and US gas production continues to grow.

Freeport LNG, headquartered in Houston, Texas, announced in mid-August that first liquid had been produced from Train 1 and that the plant would load its first cargo by the end of the month. Freeport LNG will see another train come on-stream in January 2020 and Train 3 will start up in May next year. The three trains will produce 15 million tons per year of LNG. The company plans to build a fourth train in the future. The Elba Island LNG plant will also bring four of its 10 trains on-stream in the next few months.

Virginia-based Venture Global announced last month that it had closed project financing for its $5.8 billion Calcasieu Pass LNG plant and gas pipeline in Cameron Parish, Louisiana, which will produce 10 million tons per year when it begins commercial operations in 2022. Venture Global is also developing two 20 million ton/year export facilities at Plaquemines Parish, Louisiana.

Commonwealth LNG has also sited its planned 8.4 million ton/year, six-train terminal in Cameron Parish. Last month it filed a formal application for a permit with US regulators to build the export facility and feed gas pipeline. Commonwealth joins a dozen other companies regarded as the 'second-wave' of LNG projects that will likely be in operation by the middle of the next decade and make the US one of the world's largest LNG exporters.

In its latest monthly report on energy production in the US, the US Energy Information Administration (EIA) forecast that natural gas production in the US would average 91.0 billion cubic feet per day (bn cfd) during 2019, up by 7.6 bn cfd over 2018. It said that monthly production averages would grow in late 2019 and decline slightly during the first quarter of 2020 as the lagged effect of low prices in the second half of 2019 reduces natural gas-directed drilling. But output would grow again beginning in the second quarter of next year and production for 2020 would average 92.5 bn cfd.

As an indication of US gas production growth, the EIA report said gas inventories settled 13 per cent higher in July at 2.7 trillion cubic feet, from a year ago. But they were down by 4 per cent from the five-year (2014-18) average. But the agency forecast that gas storage injections through the April-October 2019 injection season would rise and put inventories at 3.7 tcf by the end of October, some 16 per cent above inventories in October 2018.

The EIA also said that deliveries of natural gas to LNG exporting facilities during July set a monthly record averaging 6.0 bn cfd, which accounts for 7 per cent of US daily dry gas production. It said that during the first seven months of this year, natural gas feedstock deliveries to LNG export facilities have been the fastest growing among all US natural gas consumption sectors.

The report estimated that US LNG exports set new records in June and July at 4.8 bn cfd and 5.2 bn cfd, respectively. Gas feedstock deliveries to the terminals averaged 5.5 bn cfd in June and 6.0 bn cfd in July.

At present, total US LNG capacity is 5.4 bn cfd from four facilities and nine liquefaction trains. This includes the Cheniere-operated Sabine Pass LNG facility on the Louisiana-Texas border, Cove Point LNG in Maryland, and Corpus Christi LNG. During the first half of this year, two new trains came online: Cameron LNG Train 1 in Louisiana in May and Corpus Christi LNG Train 2 in Texas in June.

A report published by the EIA last December forecast that US LNG output would average 8.9 bn cfd by the end of 2019. More export terminals – Magnolia LNG, Delfin LNG, Lake Charles, Golden Pass and a sixth train at Sabine Pass, with a total production capacity of 7.6 bn cfd – will come on-stream over the next decade.

This begs the question about where all of this LNG will go. Much of it will likely head to Asia, where the market continues to grow despite the slowdown in China, and to China, if Beijing and Washington can successfully bring their trade war to an end. Europe is another big target for US LNG. US producers and politicians are keen to cut into Russia's market share and also take up whatever slack might arise as Europe's traditional gas supplies slip. Demand for cleaner fuel as the world comes to grips with the climate crisis will also factor significantly.

A digital approach to tackling climate change

Digital innovation combined with technologies such as the Internet of Things and artificial intelligence are key to ensuring climate neutrality by 2050, says **Hanno Schoklitsch**

In recent times, it has become abundantly clear that something must be done about climate change. According to a recent Intergovernmental Panel on Climate Change (IPCC) report, global emissions of carbon dioxide must peak by 2020 to keep global warming below 1.5°C. And with the energy sector responsible for 61.4 per cent of global carbon emissions, people are demanding large-scale action from within the energy sector itself.

The detrimental effects of climate change have put in motion an unprecedented mass movement calling upon governments, organisations and businesses to take the lead. In response to this demand for action, the EU has proposed to cut its emissions by 80-95 per cent by 2050 compared to 1990 levels. It's a gargantuan task in which digitalisation plays a fundamental role.

While many solutions, both big and small exist, only digitalisation and technological innovations can drive the renewables sector quickly enough and on a large enough scale to effect the changes required to combat climate change. Digital innovation and technologies must work hand in hand to transform the world we live in and bridge the gap between companies and this new digital world.

When it comes to combating climate change, there's good news and bad news. The good news is that carbon emissions are declining. Some think they'll be 20 per cent lower by 2050 than they are today, in relation to the reference case. However, the bad news is that they still remain far away from the less than 2°C pathway laid out in the 2016 Paris Agreement.

Even in an accelerated scenario, it is unlikely this 2°C goal will be achieved unless extraordinary measures are taken, measures that include greater private investment and data analytics support for more efficient performance of clean power production. Even as renewable energies like solar and wind are becoming big global and profitable businesses, carbon emissions continue to be released into the atmosphere.

This is in spite of the fact that between 2014 and 2018 the average yearly investment in clean energy has been close to £245 billion ($300 billion). This jump in energy investment has been encouraged by lower renewable energy costs that have beat hydro, coal and gas options. In fact, the most recent data available suggests the lowest auction value for wind and solar tariffs of under $25/MWh in Mexico, Morocco and Dubai show that exceptionally low values can be translated into large projects in countries with average wind and solar conditions.

With a multiplicity of right locations with high wind or solar load factors and low grid connection costs, it is hard to believe that the battle to decarbonise the planet is being lost.

The Internet of Things (IoT) and Artificial Intelligence (AI) are key to changing the course of this battle through their ability to maximise both efficiency and returns, while providing greatly increased transparency. And that can only happen when the management of the generation assets of the renewable sector integrate both technical and financial aspects.

Although IoT is an unparalleled source of data, it is AI that makes this data actionable and operationally functional. As AI processes data in real-time, algorithmic decisions are made and acted upon without any time lag. It can also identify patterns and undetected situations within the data over time, which means predictive and augmented analytics can be applied to guarantee that any operation or function is running at maximum efficiency.

The emerging Data as a Service (DaaS) industry is becoming a critical link between investor and operator as well as producer and consumer. In the near future, other vital parts of the system, like grid integration and balance, blockchain, load management and storage, will be interceded by DaaS operators. Data platform services are particularly essential for maximising performance of power generation by minimising risks and costs while maximising returns. It is growing to the extent that Statista suggests that the market for DaaS and machine learning data preparation, something that relies heavily on IoT, is expected to reach $2.5 billion by 2023.

It is fundamental that this begins to be applied more in the renewables sector. In most industrialised countries, renewable energies already represent around 15-25 per cent of total power generation globally, most of which is hydro. Looking into the future, say by 2050, around 50 per cent of all electricity produced will be based on renewable sources. Hydro will represent roughly 20 per cent while more than half of that 50 per cent will be solar and wind.

Over the past 20 years, renewables have grown from practically nothing to close to 20 per cent average worldwide. Some places may have reached 80 per cent or more while in others they are reaching 10 per cent. But we will see a situation where half of all power generated in the world, say by 2050, will be entirely driven by economics. By 2025, even with the added costs of 'system-integration', where batteries or other flexible sources of power generation are needed to complement them, renewables will be cost effective.

Data is the key to attracting the required capital to unlock the full potential of renewable energy assets that are driving the green energy transition. A key obstacle facing the renewables sector is a lack of investment due to the financial and performance risks associated with this type of investment.

Despite the fact that digital technologies can provide unparalleled security and transparency, in a recent report published by DNV GL, 40 per cent of finance industry respondents said they were not using digital technology at all. The potential of the technology must therefore be harnessed and showcased to investors to demonstrate how they can provide investment security, risk management and portfolio management for assets from anywhere and at any time. Only this can change the financial sector's reluctance to take advantage of new digital technologies. This is especially pertinent now given that the viability of investment in fossil fuels is plummeting, which is helping to narrow the significant profitability gap that had put off investors before.

Indeed, a recent study conducted by McKinsey demonstrated that by 2050, almost 26 per cent of energy will come from renewable resources, and notably, 7 per cent will come from wind and solar sources. Moreover, a BNP Asset Management Study conducted this year found that for the same capital outlay, wind and solar projects will produce three to four times more useful energy at the wheels of electric vehicles than oil will at $60/barrel for diesel-powered vehicles. Renewables have become much more than an ethical or moral imperative; investment in clean energy sources is now grounded in cold, hard economic logic and long term profitability.

The opportunities afforded to investors by the digitalisation of energy investment are two-fold. Firstly, computing power is constantly increasing and enabling greater levels of AI and machine learning to build the digital platforms and operators that understand the investment situation on a local level. Further, thanks to the IoT, the data available to these computers for analysis is increasing exponentially, which means that investments can be optimised more readily and risks drastically reduced.

Digital platforms that mobilise AI tools are able to process financial information and create an all-inclusive data package by aggregating technical, meteorological and financial data to create a database. This is then used to provide digestible information to investors in the form of KPIs, thereby helping to maximise the performance of assets and portfolios. Such advances in the digitalisation of energy allows for better decisions to be made and automated, which provides investors with greater levels of transparency.

This confidence in the guarantee of returns on investment through greater investment security can only be attained through the aggregation of technical and financial data stored in digital platforms, and transmitted in real-time to investors. The capabilities of the IoT, machine learning and AI to position renewables as a rational, viable, and profitable economic investment are limitless.

The advent of digital platforms and technological advances also have the potential to impact everyday consumers in vast and tangible ways. It also means that energy consumption is more controlled, efficient and kept to reasonable levels.

This can also be applied in the motor industry. Rolling out smart charging technologies for electric vehicles could help shift charging to periods when electricity demand is low and supply is abundant. This would provide further flexibility to the grid while saving $100-$280 billion in avoided investment in new electricity infrastructure between 2016 and 2040.

The possibilities that the digitalisation of the energy sector presents are endless. If we capitalise on digital innovations we can gain insight into optimised forecasting of asset performance, lifetime and generation level, which is something we have never had before. Now more than ever, the EU and other national and supranational organisations and governments have the digital solutions and the incentive required to further propel the renewable energy transition and increase the global market for clean energy sources.

Schoklitsch: confidence in the guarantee of returns on investment can only be attained through the aggregation of technical and financial data stored in digital platforms, and transmitted in real-time to investors

Hanno Schoklitsch is a Civil Engineer and founder & CEO of Kaiserwetter, an energy IntelliTech company.

Who will beat the clock?

EY's latest research indicates that the three drivers underpinning the energy transition – decarbonisation, decentralisation and digitalisation – are progressing faster than even the most ambitious estimates, putting the industry on a countdown to an accelerated reinvention.
Benoit Laclau

Three drivers underpin the energy transition: decarbonisation; decentralisation and digitalisation. A year ago, EY mapped these drivers, sometimes called the 3Ds, to determine exactly when these three tipping points would change the way utilities do business forever and set the industry on a countdown to reinvention.

Since then, we have completed analysis of how these critical milestones will impact seven mature and emerging energy markets: Europe, the US, Oceania, the Gulf Cooperation Council (GCC) countries, China, India and Latin America. Though different markets are following a similar trajectory toward the same decentralised and distributed destination, they are at different stages in their evolution.

According to EY's latest research the 3Ds are progressing faster than even the most ambitious estimates, bringing forward the tipping points in some markets by as much as two years. And as the journey to a decarbonised, electrified world speeds up, the urgency to act has intensified. Four key actions on the part of all energy stakeholders are critical if the transition is to achieve its potential.

■ First, energy companies must move faster to transform. Energy companies are not keeping up with the pace of change. Time is running out to gain the new capabilities – and a mindset – that will be key to success:

- Generators must adopt a two-pronged strategy. First, they must cut costs to remain competitive as grid parity looms. Second, play to other strengths that carve out a new role. For example, the ability to provide a reliable, secure and diverse supply of electricity will be of increasing value in a distributed energy world. Already, leading generators are putting their deep sector knowledge to play a central role in the growth of the electrification of transport, storage and microgrids. Owners and operators of generation plants that partner with developers that are flexible in providing both centralised and decentralised solutions will enjoy distinct advantages in the future energy world.

- Networks must rethink their entire role. The days of facilitating simple, one-way energy flows are long gone. Network companies must consider instead how to build a new type of network operator that integrates and optimises a multi-directional flow of supply and demand from multiple sources. This requires gaining key capabilities, including the active management of dynamic real-time activity across the network, while still maintaining adequate physical capacity to meet demand.

- Retailers will be without a viable business model sooner rather than later as consumers, particularly those in business, become increasingly self-reliant and less dependent on the grid for energy supply. Remaining relevant requires retailers to redefine their relationships with customers, considering how to help, rather than hinder, their renewable energy aims. For example, retailers can provide their expertise to businesses as they build their own solar energy system or choose the right PPA. Leveraging digital capabilities will position companies to offer more innovative energy services, such as tailored demand response programmes or power factor correction.

■ The second key action is that regulators and policymakers must adapt to change. Governments and regulators risk stalling the energy transition if they do not adapt with agility. Moving to a flexible, risk-based regulatory model that balances consumer interests and innovation is needed if energy companies are to transform in time.

During 2019, California will enact a wide-scale rollout of time-of-use (TOU) rates across 20 million customers. Pilot programmes are ongoing across the US to determine the effectiveness of TOU.

Accelerating EV adoption will require going beyond incentivising customers to buy cleaner cars. Rewarding energy companies for playing their role in driving the shift to electrified transport demands urgent policy updates, as seen in more forward-looking regions. In Arizona, policymakers now allow utilities to recover investment in EV charging infrastructure through rates.

Helping energy companies shift their business models from those purely based on selling as much electricity as possible requires new ways to reward performance. Regulators should consider revenue decoupling, which separates an energy company's sales from its revenues and profits. Rates of return are aligned with revenue targets, and rates are adjusted accordingly to meet the target at the end of the adjustment period. This improves the case for deploying energy efficiency and distributed generation solutions, as the operating environment becomes less incentivised to expand traditional energy sales.

Performance-based regulation (PBR) must also be explored as a tool to better incentivise utility investment in distributed generation, energy efficiency and demand-side management solutions. Globally, the most common form of PBR is multi-year rate plans (MRPs), which feature a moratorium on rate cases for several years – frequent rate cases are associated with poorer performance and higher customer costs.

MRPs balance incentives for cost containment with incentives to strengthen performance in targeted areas, which may include utility conservation programmes focused on smart grid innovation, distributed generation and energy efficiency. Prominent examples include the UK's RIIO and New York's Reforming the Energy Vision; but there are also leading MRPs in Australia, Germany, the Netherlands and New Zealand.

■ Third, new financing models must encourage investment in new energy solutions. The true innovation seen across the energy sector is yet to make much of an impact on the financing structure that funds it. But, as the energy transition amplifies the risk of diminishing returns to traditional investors, finding new sources, and models, of funding is critical.

Energy companies must explore new investment models that share risk and rewards and encourage collaboration. For example, shared risk ownership models allow technology developers or other third parties to own and operate assets in partnership with the local utility. Those with real foresight could offer 100 per cent clean power to customers, including corporate buyers, taking on the complexities around price and supply risk.

Others may follow the lead of those energy companies that have already established venture capital funds to pursue innovation.

And, almost all must consider how to join forces with players within the wider energy ecosystem. Funding the energy infrastructure and networks fit for the future will be a team effort.

■ Fourth, collaboration is necessary for innovation. All stakeholders in the energy system must realise that the challenges of the sector cannot be solved in isolation. When industry players, regulators, governments and companies in adjacent sectors work together, there is greater potential to unlock the innovation that is needed to address the most complex energy challenges.

For example, partnering with technology companies can help utilities better leverage digital innovation – Southern California Edison has collaborated with Google Nest thermostats to roll-out a residential demand response scheme that helps balance the grid on hot summer days. Working with automakers is a natural fit – Sweden's Vattenfall has partnered with Volvo to deliver, install and service EV charging boxes. Meanwhile, better meeting the specific energy needs of corporate customers requires a sophisticated understanding of commercial and industrial energy management – Enel acquired US company EnerNOC to position Enel X as a leader in this space.

But sector convergence and the digitalisation of energy open up almost endless opportunities for non-traditional collaborations. Energy companies must take an open-minded approach to partnerships, considering how best to combine knowledge, skills and customer bases to tap new revenue streams.

Embracing flexibility may be the best strategy. Will the tipping points move even closer when we next update our analysis? The answer is probably yes, given the faster than expected evolution of the energy sector so far, particularly regarding the decentralisation of electricity generation. A compressed countdown to transformation amplifies pressure on energy companies, regulators and other stakeholders to be ready in time. Time is short to transform businesses, reform regulation, develop new financing models and build the cross-industry collaborations that will solve the most complex energy challenges.

But, while navigating the brave new energy world requires a robust strategy, perhaps the best approach is to embrace flexibility. Exploring different possible futures, the levers that influence them and the interactions that arise within a complex energy system is critical to survival. Disruption, by its nature, is unpredictable. As it continues to reshape the energy sector, those energy companies that are agile enough to take advantage of new paths to growth will be ready to capture value, wherever it emerges, in the new energy world.

The clock is ticking.

Benoit Laclau is Global Energy Leader at EY.

"Will the tipping points move even closer when we next update our analysis? The answer is probably yes, given the faster than expected evolution of the energy sector so far…"

Laclau: Embracing flexibility may be the best strategy

Demanding a response with blockchain

Blockchain technology has been used to develop a system for trading related to energy shortages and surpluses among electricity consumers, including factories and retail stores. ***TEI Times*** reports.

Demand response (DR) is a scheme in which electric utilities and consumers of electricity cooperate to control the amount of electricity used during periods of expected peak demand. An ongoing issue, however, is that the success rate for DR controls can be low, with consumers being unable to deliver the amount of power savings requested by the electric utilities.

Earlier this year, Japanese company Fujitsu announced that it had devised a system based on blockchain, in which electricity consumers can efficiently exchange, among themselves, the electricity surpluses they have produced through their own electricity generation or power savings.

Working together with electricity aggregator ENERES Co., Ltd., which provided real-life data, Fujitsu conducted a simulation that demonstrated a significant improvement in the DR success rate.

It is potentially an important development. DR has been in the spotlight as renewable energies and other initiatives are put in place to develop a carbon-free society.

DR, in which electric utilities and electricity consumers cooperate to control the amount of electricity use, aims to reduce electricity consumption, particularly at peak times when shortages of electricity supply are expected, by paying compensation to electricity consumers who contributed to power savings.

In practice, DR is arranged so that an aggregator, who receives the request for power savings from the electric utility and controls the amount of each consumer's power savings, acts as the middleman, and assigns the amount of the consumer's power savings. When the amount of power savings requested is achieved, the aggregator then receives remuneration from the electric utility.

The aggregator also distributes the remuneration to contributing consumers based on the amount of power savings they achieved. However, consumers are sometimes unable to meet the request from the aggregator, due to shortages in the electricity produced when they operate their own generator or due to sudden spikes in their energy consumption. This leads to cases of consumers being unable to receive compensation.

Increasing the success rate of DR means improving the number of consumers compensated for achieving their power savings targets, along with the number of participants taking part.

At present, the aggregator interacts with individual consumers on a one-to-one basis to allot power saving amounts and to confirm whether the request can be acceptable for the consumer. For electricity consumers to achieve their power savings targets with a high probability, a transaction that allows a consumer who is short of meeting its targets to quickly exchange a portion of another consumer's power savings amount has to be done effectively. This, however, has yet to be achieved in DR.

This is where Fujitsu's recent work has been focused. Fujitsu Laboratories has applied blockchain technologies to create a system of exchange in which electricity consumers, who have contracted with an aggregator, can exchange chunks of power savings amongst themselves.

With DR, it is sometimes necessary to quickly respond to the aggregator about whether power savings can be achieved. Fujitsu Laboratories' technology first calculates the total amount of electricity that can be offered from the sell orders registered on the exchange system, and determines which buy orders can be settled quickly, in turn, for the quantities that can be purchased. As a result, the technology makes it possible to quickly reply about whether power savings targets can be met.

The company also developed a technology that optimises pairing exchange orders so that, after the response, required sell orders are distributed to the completed buy orders without waste.

This two-phased electricity exchange technology (patent pending) is built on blockchain, which guarantees the transparency of recorded exchange transaction results. This enables the accurate distribution of remuneration based on the transaction results of finalised selling and buying of power savings.

With this exchange system, even when the requested amount of power savings is difficult to achieve, a consumer can quickly purchase the surplus electricity of another consumer to supplement its own power savings goals, leading to more reliable achievement of the targets.

With the cooperation of ENERES, Fujitsu conducted simulations of the new system in the summer and winter terms of 2018. Using the actual logs of energy consumption of 20 consumer sites, the companies observed the situation in which electricity consumers could exchange electricity among themselves. As a result, the company confirmed a maximum improvement to the DR success rate of about 40 per cent, compared to conventional methods.

Masanobu Morinaga, Research Manager, ID Trust Project, Security Research Laboratory at Fujitsu Laboratories, commented: "Improvement to the DR control success rate is expected to lead to more consumers participating in DR schemes. Moreover, this will enable the stable supply of electricity and the expansion of renewable energy use – another goal of the DR scheme."

Fujitsu is a member of the RE100, which aims to have companies use 100 per cent renewable energy for the electricity they consume, and as such is putting measures in place to build a carbon-free society. As part of these efforts, the company is carrying out verification of this system in a real-world environment, with the goal of commercialisation from fiscal 2019.

What is blockchain?

Blockchain is the technology underpinning the digital currency, Bitcoin, enabling transactions involving the cryptocurrency to be recorded, traced and made publicly available. But since the release of Bitcoins in 2009, developers have come to realise the potential for the use of blockchain in other industries.

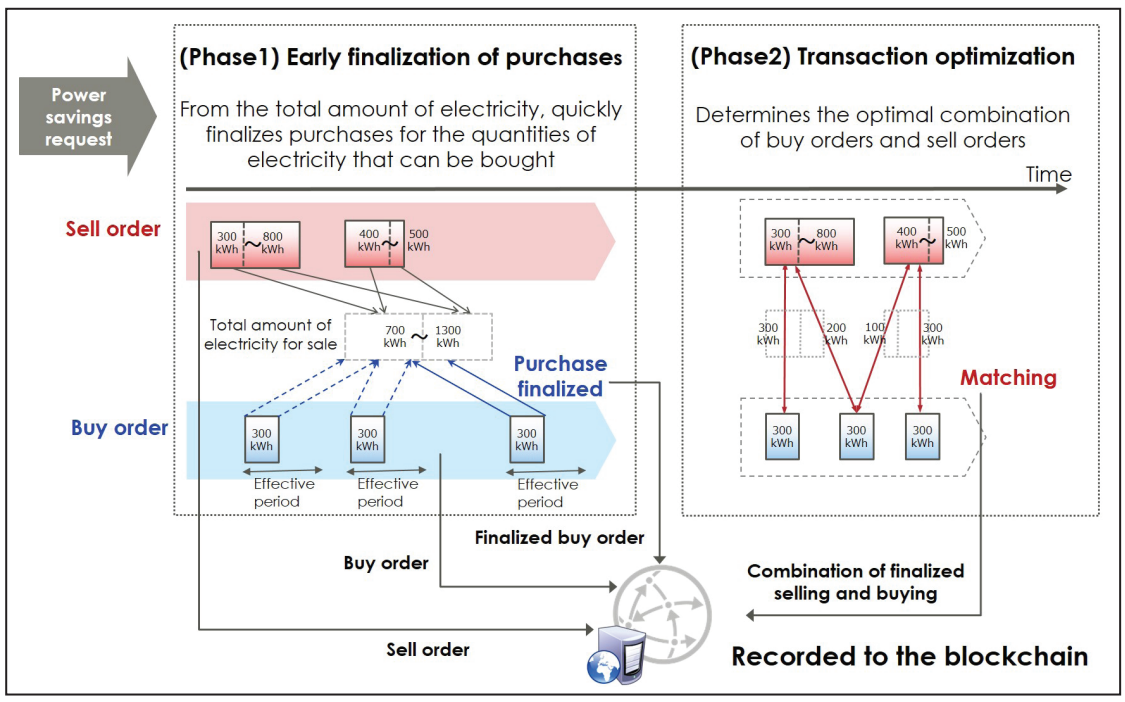
The technology has the potential to change the way the energy sector arranges, records and verifies transactions, with the underlying model shifting away from a centralised structure (exchanges, trading platforms, energy companies) towards decentralised systems (end customers, energy consumers interacting directly).

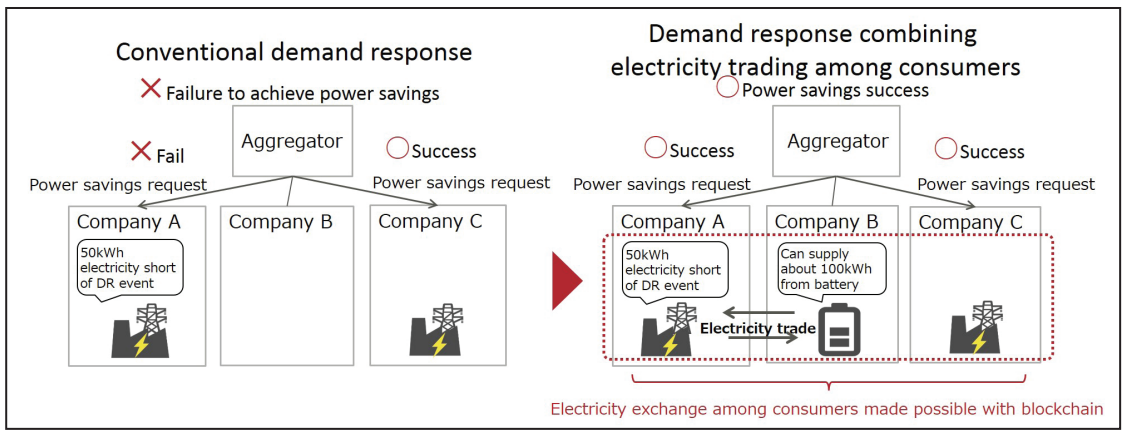
It allows digital information to be distributed, but not copied. That means each individual piece of data can only have one owner. It can be described as a "digital ledger" stored in a distributed network.

Blockchains essentially create a digital ledger that records and continually reconciles transactions – and other types of information – across a distributed network. These records are available to – and can be updated by – anyone with access to that network. Blockchains therefore eliminate the need for central oversight of a ledger, and enable information flows to be managed quickly and efficiently.

Crucially, blockchain enables ledgers to be shared transparently and are immutable, i.e. they cannot be altered, and they therefore build trust between partners in a transaction. Anything of value to a business – tangible or intangible – can be tracked and traded securely, without the need for third parties.

Outline of technologies for electricity exchange transactions among consumers





The system allows consumers to exchange electricity as part of a demand response scheme

Junior Isles

Lightning could strike twice…

Lightning doesn't strike twice in the same place, or so they say, but it happens often enough for grid operators to prepare for the eventuality. Yet the UK system seemed unprepared for a set of circumstances that caused widespread power cuts that not only disrupted trains but also left almost 1 million consumers, including a hospital, without power.

According to UK grid operator National Grid, a lightning strike was partly to blame for what was the country's largest blackout in a decade. Some, however, took the opportunity to blame the event on the growing amount of renewables on the network.

In the immediate aftermath of the blackout, Justin Bowden, National Secretary of GMB, the UK energy union, said: "Whatever the final outcome of the blackout inquiry some lessons should already have been learned to make sure lightning doesn't strike twice.

"National Grid must make sure it has enough spare capacity to cope with unexpected outages – which will only become more frequent as we switch over to renewables. Reasonably priced, reliable energy is not an optional extra in our low carbon future, it is an essential right.

"The reliable, ultra-low carbon electricity from new nuclear power stations will be vital – not only during the transition to a zero carbon world, but to ensure continuity in our electricity supply once we get there. Some green groups have yet to face up to this reality."

There is some basic logic to the argument. High volumes of renewable energy make it more difficult for National Grid to maintain the frequency of the grid, which was originally built to accommodate base load, predominantly fossil fuel, power plants.

Yet any call to return to conventional generation sources and maintaining the old ways is somewhat of a knee-jerk reaction.

Lightning strikes are common in National Grid's infrastructure, which is hit on average three times per day, and rarely cause serious problems. But National Grid said in an interim report that a lightning strike on a transmission circuit, followed by "two almost simultaneous unexpected power losses" at two power plants, caused the disruption on August 9.

Problems on the grid started when lightning hit part of the network near Cambridge. This caused 300-400 MW of capacity in the local electricity network to go offline. The outages at Hornsea off-shore wind farm and Little Barford gas power station, causing a combined loss of about 1400 MW, occurred independently but each was associated with the lightning strike.

Analysts have speculated that Hornsea may have disconnected from the grid if its safety systems were configured too sensitively to drops in frequency. Ørsted, the wind farm owner, acknowledged that a "technical fault" had meant that the wind farm "rapidly de-loaded", but made no further comment while it investigates the issue alongside the energy regulator.

The scale of generation loss caused the network's frequency to drop, and the level of backup power required under the regulatory standards was insufficient to cover the loss, the report from National Grid Electricity System Operator said.

As a result, the system automatically disconnected customers on the distribution network – resulting in about five per cent of electricity demand being turned off to protect the other 95 per cent.

"As generation would not be expected to trip off or de-load in response to a lightning strike, this appears to represent an extremely rare and unexpected event," said the report.

But how rare and "unexpected" was it, really? According to the *Mail on Sunday*, in April, National Grid published research warning that using more renewable power sources "posed a threat to the network's stability". In a report based on a £6.8 million research project, National Grid admitted that renewables increased the "unpredictability and volatility" of the power supply which "could lead to faults on the electricity network".

There is also precedent. In Australia last year, a lightning strike caused the Queensland and South Australian interconnectors to trip simultaneously on August 25, forcing electricity to be cut to big industrial users and retail customers in New South Wales and Victoria. An official investigation found thousands of rooftop solar units did not comply with Australian standards and has raised the prospect of household rooftop solar panels being retrofitted to ensure they meet compliance standards after some units failed to adequately respond to the interconnector outage.

And just a few weeks ago, the Australian Energy Regulator said it will take four South Australian (SA) wind farm operators to court, accusing them of failing to perform properly during SA's state-wide blackout in 2016. The allegations relate to the performance of wind farms during the severe weather event that swept across SA in September 2016, which ultimately triggered the outage.

The storms damaged more than 20 towers in the state's mid-north, bringing down major transmission lines and causing a knock-on effect across the state's energy grid.

A report from the Autralian Energy Market Operator (AEMO) released about a month later found nine of 13 wind farms online at the time of the blackout switched off when the transmission lines came down.It found the inability of the wind farms to ride through those disturbances was the result of safety settings that forced them to disconnect or reduce output.

The blackout sparked a war of words between supporters of renewable power and those who blamed SA's high reliance on wind and solar generation as a contributing factor.

But there will always be those unwilling to embrace change. Wind and solar will indeed increase grid instability – but let's not forget that there have also been significant power cuts in the past, long before wind and solar were prevalent. No system is perfect. What power providers and grid operator are learning now, is that losing large, base load generation can be a problem, if not planned carefully.

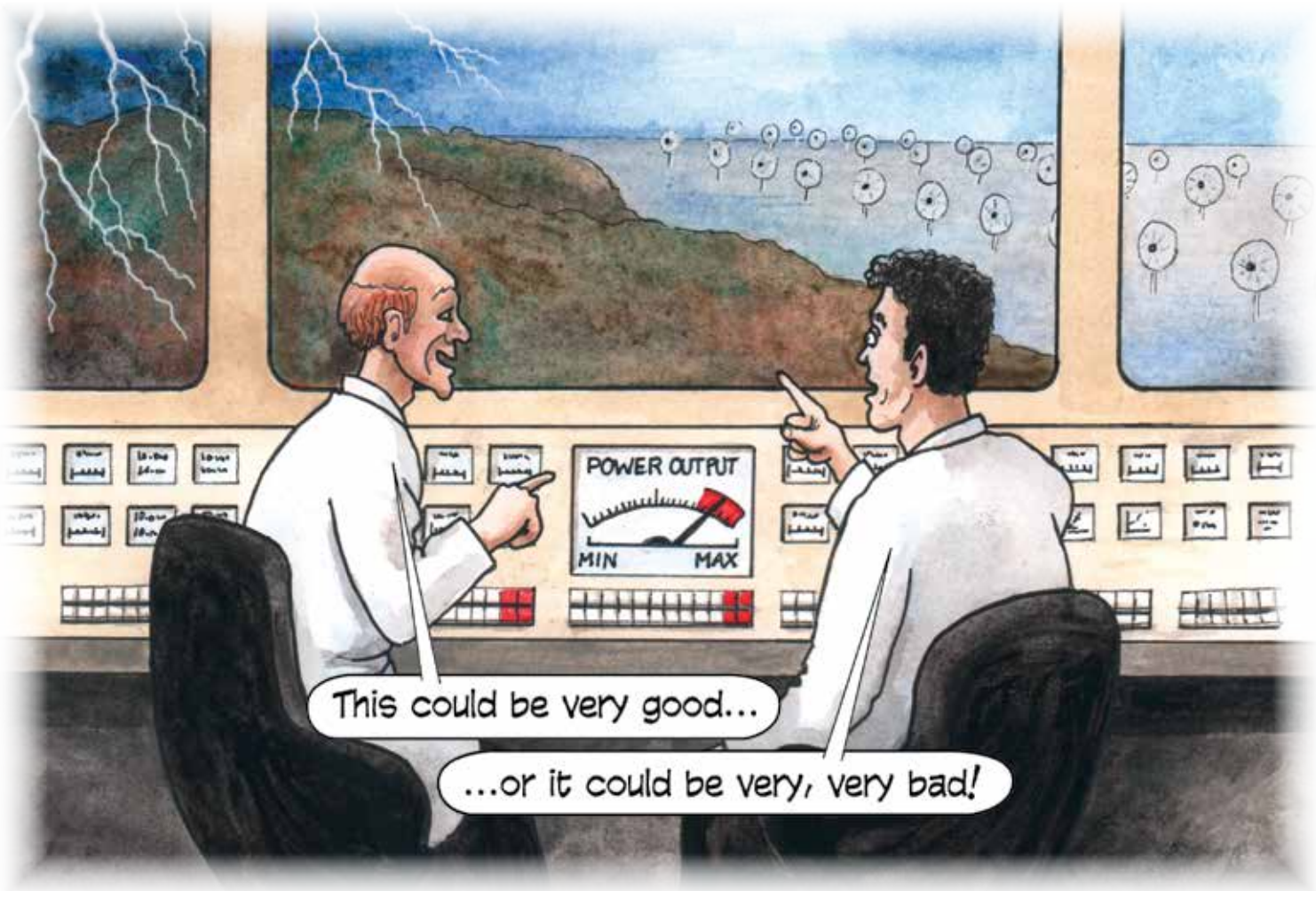
Lessons are being learned and it will take time to make the adjustments. National Grid has developed a frequency 'monitoring and control system' to deal with issues arising from the drive to renewables. It should be operational by 2025 when it expects to have moved to a 'zero carbon' electricity system.

A spokesman for National Grid said: "As we move to a more renewable system we are creating new markets and products to manage this effectively. We are confident we will be able to operate Britain's electricity at zero carbon by 2025 with a safe and resilient network, given the right regulatory framework and incentives."

Jeremy Nicholson, an expert at energy consultancy Alfa, said: "This is not about wind being unreliable. It's about having the right system in place to accommodate it. It's a question of doing it safely."

John Pettigrew, National Grid's Chief Executive, described the outage as a "once-in-30-years" event and said there was "nothing to indicate that it was anything to do with the fact that we are moving to more wind or more solar".

Indeed, renewable energy in itself should not be blamed for blackouts, or used as an excuse by some to stick with conventional, polluting generating sources. And in any event, it is a moot point; the renewables ship has already set sail. But what governments must do now, is accelerate the transition of networks through the use of storage and demand response schemes etc., to create a more dynamic system that is both resilient and meets climate change ambitions. Hoping for lightning strikes to not coincide with other infrequent events is no plan at all.



Cartoon: jemsoar.com