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Special Supplement

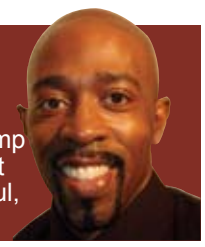
With digitalisation and decentralisation becoming more widespread in the energy sector, cyber attacks are on the rise.

Incentivising energy storage

The success or failure of storage programmes in the US may inform the decisions of other regulators as they formulate their own policies. ***Page 14***

Final Word

The IEA's World Energy Investment 2017 reveals a slump in global energy investment but there are reasons to be cheerful, says Junior Isles. ***Page 16***



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Electricity sector investment overtakes oil and gas

Varro: wind and solar have been doing "very well"

The electricity industry is leading global energy investment as the sector continues to transform to low carbon generating sources. **Junior Isles**

Electricity sector investment has overtaken investment in oil, gas and coal supply for the first time, driven by the global clean energy push and a continued drop in upstream oil and gas spending. The International Energy Agency (IEA) noted, that the electricity sector's share (including networks) in overall energy investment – grew 12 percentage points in 2016 to 43 per cent of the overall energy spend.

According to the World Energy Investment (WEI) 2017 report launched by the IEA in mid-July, total energy investment worldwide was around $1.7 trillion in 2016, 12 per cent lower than 2015 in real terms. The lower investment is largely attributed to lower costs in sectors such as wind and solar PV, as well as in upstream oil and gas.

Global electricity investment was nearly flat (down just 1 per cent) at $718 billion, with growing network spending mostly offset by fewer coal fired power plant additions.

Notably, investment in renewable-based power capacity was the largest area of electricity spending. Although renewable investment fell 3 per cent to $297 billion, it will generate 35 per cent more power thanks to cost declines and technology improvements in solar PV and wind.

The report finds that progress in technology and project management are driving down solar and wind costs, reflected in low generation contract prices. Solar PV unit capital costs fell 20 per cent in 2016, partly offsetting a 50 per cent rise in additions.

Launching the report, Laszlo Varro, the IEA's Chief Economist said: "The biggest area of power generation investment is renewable, low carbon generation. Wind and solar power have been doing very, very well and 2016 was a record year. We can expect 200 TWh of electricity from the wind and solar investment [made] in 2016."

Coal fired generation, however, continued to suffer with Laszlo saying that the days of coal as a major power generating source were numbered.

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G20 stands firm on climate pact

Despite the US withdrawal from the Paris Agreement, all of the other G20 members maintain the climate accord is "irreversible" in a joint statement issued after last month's summit in Hamburg, Germany.

After lengthy negotiations, the final joint statement noted US President Donald Trump's withdrawal from the Paris deal while stating that the world's other major economies all still support the international effort to slow dangerous global warming.

The communiqué stated: "We take note of the decision of the United States of America to withdraw from the Paris agreement," adding, "The leaders of the other G20 members state that the Paris agreement is irreversible" and "we reaffirm our strong commitment to the Paris agreement".

The US did, however, successfully manage to insert text referencing fossil fuels which read: "The United States of America states it will endeavour to work closely with other countries to help them access and use fossil fuels more cleanly and efficiently."

The German chancellor, Angela Merkel, said she "deplored" the US exit from the agreement and added that she did not share the view of British Prime Minister Theresa May that the US could decide to rejoin the pact.

The strongest proponents of the climate deal, including Merkel and the French president, Emmanuel Macron, have attempted to shore up support for the Paris deal among countries following Trump's decision to exit the agreement. Saudi Arabia and Indonesia were reportedly considering watering down their commitment to the deal but they ended up reiterating their support at the G20 summit.

During the summit, Germany played down a threat from Turkey to abandon the Paris Agreement amid fears that countries could start using the US decision to quit the global deal to demand more money from wealthy nations.

More than 150 countries have formally ratified or joined the accord that came into effect last November but Turkey is one of around 40 nations yet to take such a step.

Turkey's President, Recep Tayyip Erdogan, surprised G20 summit members when he told reporters his country may be less inclined to ratify the Paris agreement following the US decision, suggesting it could jeopardise funds promised to developing countries.

Barbara Hendricks, Germany's environment minister, downplayed Erdogan's remarks saying "it's about access to international financial mechanisms", rather than a fundamental rejection of the Paris accord.

The leaders of the world's 20 wealthiest economies also released the Climate and Energy Action Plan for Growth at the meeting. It calls for continued efforts to mobilise private sector investments in renewable energy and to tackle the challenge of integration of greater volumes of green energy into the energy systems. The document also says that the energy transition should happen not only in power generation but also in the heating and cooling, transport, and industry sectors.

The action plan notes that flexibility options such as interconnection and transmission capacities, demand side management, smart grid technology and energy storage, among others, are key elements of a reliable and resilient energy system. G20 members say they will also work to improve the functioning, transparency and competitiveness of gas markets, as natural gas also has a role to play in the energy transition, including for providing increased flexibility for the integration of variable renewable energy.

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As the world's largest energy investor, China saw a 25 per cent decline in coal fired power investment last year and is increasingly driven by clean electricity generation and networks, as well as energy efficiency investment, said the report.

China's focus on energy efficiency reflects a growing global trend. Investment in energy efficiency rose 9 per cent to $231 billion with China being the fastest growing region, accounting for 27 per cent of the total last year. At this rate, China could overtake Europe as the leading spender on energy efficiency within a few years, says the IEA.

India became the fastest growing major energy investment market with spending up 7 per cent, thanks to a strong government push to modernise and expand the power sector.

The report also highlighted the ongoing challenges facing the oil and gas sector. Capital spending in oil, gas and coal continued to plunge, falling by 25 per cent compared with 2015 but still accounts for 40 per cent of global energy investment. The report stated that the sector would see a 6 per cent "nominal" bounce back in upstream investment in 2017.

In the US, investment in oil and gas fell sharply, with the country accounting for 16 per cent of global spending. It did note, however, that after two years of unprecedented decline, global upstream oil and gas investment is expected to stabilise in 2017.

In a separate report, the IEA said the global natural gas market is undergoing a major transformation driven by new supplies coming from the United States to meet growing demand in developing economies.

In its latest market analysis and five-year forecast on natural gas, 'Gas 2017', it says this evolution of the role of natural gas in the global energy mix has far-reaching consequences on energy trade, air quality and carbon emissions, as well as the security of global energy supplies.

Global gas demand is expected to grow by 1.6 per cent a year for the next five years, with consumption reaching almost 4000 billion cubic metres (bcm) by 2022, up from 3630 bcm in 2016.

China will account for 40 per cent of this growth. Demand from the industrial sector becomes the main engine of gas consumption growth, replacing power generation, where gas is being squeezed by growing renewables and competition from coal.

"The US shale revolution shows no sign of running out of steam and its effects are now amplified by a second revolution of rising LNG supplies," said Dr Fatih Birol, the IEA's Executive Director.

Dr Birol added: "The environmental advantages of natural gas, particularly when replacing coal, also deserve more attention from policy makers."

Dr. Birol says gas deserves "more attention"

UK support for storage seen as "game changer"

- Government to invest £246 million in battery technology
- Ofgem to introduce new rules

Junior Isles

The UK has moved to shake-up the way electricity is produced, used and stored with the announcement that it will invest £246 million ($321 million) in battery technology over the next four years, alongside new reforms to govern a flexible energy system.

The first part of the four-year investment, called the 'Faraday Challenge', will be the creation of a "Battery Institute" led by the Engineering and Physical Sciences Research Council, which will launch a £45 million competition aimed at cutting costs for battery storage technologies.

Responding to the announcement, James Court, Head of Policy and External Affairs at the Renewable Energy Association, said: "The launch of a battery institute will help guide next-generation storage technologies through the hazards that lay between a good idea in a lab and actual deployment in homes and on solar farms.

"The UK is among the global leaders for battery technology, but for the handbrakes to be taken off we need to see the rules and regulations made in a different age updated for these new technologies and approaches… The government needs to remember that the success of batteries, renewables and smart technologies are all interlinked."

RenewableUK said battery storage is the "missing puzzle piece" that will allow the UK to maximise the potential of renewable energy resources.

Secretary of State for Business, Energy and Industrial Strategy Greg Clark announced the plan at an address to the Resolution Foundation think tank. "As part of our Industrial Strategy Challenge Fund, I am today launching the Faraday Challenge, which will put £246 million into research, innovation and scale-up of battery technology."

Gareth Redmond-King, Head of Climate and Energy at WWF said battery storage is "a clear game-changer" in the UK's ability to produce clean power from renewables.

"These technologies give us [the] flexibility to run on solar when the sun isn't shining, and be powered by wind when it is still. It will support the transition to electric cars and enable our homes to be more efficient – which means cheaper, as well as cleaner and greener energy. It is critical in engaging us all with the energy we use, and giving us the tools we need to use it better," he said.

Darren Farrar, energy segment manager at Schneider Electric commented: "As the world's need for consistent, reliable energy grows, we need to embrace innovative ways of generating and making the most of the power at our disposal. Using energy storage to unlock extra potential in renewable energy is one way to do this and it's encouraging to see the government creating mechanisms for this to take shape."

Storage technology is a central part of the move to a flexible energy system that will allow businesses and households to automatically adjust their energy consumption according to electricity price and availability.

The UK's energy sector regulator, Ofgem, was also expected to unveil new rules to govern this new energy system. The rules, due to come into effect over the next year, are designed to make it easier for the next wave of smart appliances that can respond to fluctuations in power prices to increase or reduce demand.

The government estimates that such an energy system could save UK consumers £17-40 billion by 2050.

Among the first to benefit from the new rules will be people with solar panels and battery storage. Currently, they are charged tariffs when they import electricity into their home or export it back to the grid.

An Ofgem source told *BBC News* the current rules on trading energy are not fit for the digital age because they often discourage people using energy flexibly. The rules were made before the digital revolution and before the boom in variable renewable energy.

Digitalisation is key to clean energy transition

Digitalisation of the energy sector is the only true financially viable way to achieve the Paris Climate Agreement objectives, according to Kaiserwetter, a Germany-based independent international service provider dedicated to the management of renewable energy assets.

The company noted that the power generation industry is facing an investment gap of $1.3 trillion, needed through to 2030 to meet the goals of the Paris Climate Agreement.

Hanno Schoklitsch, CEO of Kaiserwetter, commented: "The worldwide transformation towards renewable energies can only be achieved with the help of digitalisation and the Internet of Things (IoT).

"The use of digital technology will be a major contribution to the COP22 commitment to finding a financially viable way of implementing the Paris Climate Agreement objectives in the near future. Investments in renewable energies, while using the IoT and big data analytics, offer unexpected opportunities of boosting the expansion of renewable energies on a global scale."

He explained, however, that investors need tools to manage their investments in renewables in order to minimise risks. This, he says, is needed to attract the necessary financing.

Kaiserwetter has shown the potential of digitalisation with the launch of Aristoteles, a digital tool to watch and steer renewable energy portfolios from an executive level perspective. It is claimed to be the first digital solution on the market that integrates technical with financial data.

A growing number of companies are recognising the importance of digitalisation in the energy arena.

In mid-July Envision Energy, a leading global smart energy solution provider, announced an open-platform alliance that connects energy pioneers and technology innovators to help accelerate the clean energy transition through digitalisation.

The open platform alliance, known as the Energy IoT and Smart City Technology Alliance, has been launched with US partners, Microsoft and Accenture.

The alliance aims to unify the distributed and fragmented renewable energy space by seeking better ways of interconnecting buildings, industry parks, vehicles, power generation plants, electric distribution, storage and end-user consumption to help make cities smart.

Going forward, the Energy IoT and Smart City Technology Alliance will focus on enhancing technological and network exchanges and beneficial business practices among its member companies.

California secures cap and trade extension

Republicans and Democrats in California have come together to secure operation of its cap-and-trade carbon emissions programme to 2030.

The state's cap-and-trade programme – the only one of its kind in the country and the second largest in the world – is at the heart of its efforts to reduce carbon emissions. It was established by a 2006 law and launched in January 2013 to run through 2020, but its fate beyond that was uncertain.

Ali A. Zaidi is an expert on energy policy who served as Associate Director for Natural Resources, Energy and Science under President Obama and recently became a senior advisor on energy matters for law firm Morrison & Foerster.

He commented: "Regulatory certainty pinned down by a strong bipartisan vote – that is California's latest gift to public health and the innovation economy. The impact here will reach far beyond the state: California's supply chains stretch across the country and into the world; its GDP heft allows the State to set market trends. And it just did."

Bipartisan support for the system comes as Republicans in Washington, including President Trump, have blocked, resisted or undermined national efforts to fight global warming.

Following the vote, Assembly Republican leader Chad Mayes (R-Yucca Valley), who pushed members of his caucus to work with Democrats on the issue, said: "California Republicans are different than national Republicans. Many of us believe that climate change is real, and that it's a responsibility we have to work to address it."

The bill passed the Senate 28-12 and was approved 55-21 in the Assembly, earning the two-thirds "supermajority" it needed to pass. It now heads to Governor Jerry Brown for his signature.

Redefining excellence to future-proof the energy industry

As we move towards a more sustainable future, connectivity, digital transformation and efficiency are proving to be key drivers in the energy sector. Energy prices are escalating, dependency is increasing and energy sources are becoming scarcer. Compounded with meeting the mandate for the decarbonisation of traditional energy sources, the incorporation of renewable energy and an increasingly complex and decentralised network – Distribution Network Operators (DNOs) are under a lot of pressure to redefine the energy industry.

Schneider Electric's RN2d ring main unit has been designed with reliability, safety, longevity and smart integration in mind. 11kV Ring main units are the operational backbone of UK electricity networks, used for safely controlling and monitoring secondary distribution such as fixing cable faults, moving normally open points and reconfiguration to get customers back on supply as quickly as possible.

Using the latest design and modelling technologies to provide this reassurance, the Ringmaster RN2d is set to meet the demands of tomorrow. Features like the C-type bushing allow customers to use fully earth-screened C-type connections with less risk of cable box faults and put safe operation first with the evolved ring unit.

One of the greatest benefits of the RN2d is that it combines over 20 years of Ringmaster excellence with smart technology, enabling advanced communication when used with the Easergy T300, an innovative feeder automation RTU, for smart, advanced network management.

The accessories and new design offers greater flexibility with multiple applications and configurations. Its compact and flexible design makes it easy to operate and maintain, while minimising the installation footprint. The RN2d serves multiple industries and can be used anywhere, delivering optimal performance in harsh climatic and environmental conditions.

DNOs are looking for high quality, safe and versatile ring main units that can stand the test of time and withstand challenging environmental conditions. The RN2d utilises the latest design and modelling technologies to provide this reassurance and support the ongoing innovation currently driving the industry. The complex operational systems of DNOs must be supported by technology that will help them to automate and manage key processes that will ultimately reshape the industry and transform lives.

schneider-electric.co.uk/rn2d

Life Is On Schneider Electric

Southern calls time on Kemper gasifiers

■ Gasifiers hit problems in June ■ Southern to negotiate over cost recovery

Siân Crampsie

The USA's first clean coal gasification plant with carbon capture and storage is unlikely to ever operate using coal as a fuel, it has been revealed.

Regulators in the US state of Mississippi in June rejected a request by Southern Company for electricity rates to be increased in order to recoup the costs of building the over-budget, much-delayed Kemper integrated gasification combined cycle plant.

Southern then announced that it would suspend operations and start-up activities on the gasification portion of the Kemper plant, which has been operating as a combined cycle power plant using natural gas for almost three years.

The move is a blow for clean coal proponents but has highlighted the difficulties of developing state-of-the-art clean coal facilities and the need for such plants in an era of low natural gas prices and strong growth in renewables.

Mississippi regulators have also asked Southern Company for a proposal that keeps the plant operating as a natural gas fired combined cycle unit. Southern says that it still wants to recover some or all of the $3.4 billion of costs from the project.

In a stock exchange filing Southern said that its subsidiary, Mississippi Power Co., "would be required to recognize a charge to income in the second quarter of 2017 for those unrecovered costs, in addition to any other costs required to be incurred".

Southern began commissioning the Kemper plant in late 2016, achieving first electricity the facility's two gasifiers. However it reported problems with the coal gasifiers in June 2017 and said that the problems would take 18-24 months to repair.

The 582 MW plant, initially projected to cost $1.8 billion, has so far run up a bill of over $7.5 billion in construction and engineering expenses. Southern has delayed full start-up of the plant at least five times in 2017 alone.

Southern close to Vogtle takeover

Southern Nuclear and Georgia Power are closing in on plans to take over the construction of two new nuclear units at the Vogtle plant in Georgia, USA.

The two companies have inked a deal with Westinghouse, the project's original contractor, to assume control of the engineering, procurement and construction (EPC) contract, and hope to have it approved by the start of August.

Westinghouse filed for bankruptcy in March, throwing nuclear construction projects at Vogtle and at the V.C. Summer nuclear plant in South Carolina, into disarray.

The new service agreement will give Southern Nuclear and Georgia Power EPC support as well as access to the intellectual property of Westinghouse needed for the expansion of Vogtle. It also includes 'parental guarantees' from Westinghouse owner Toshiba of $3.68 billion.

The agreement will come into effect once all the necessary approvals have been obtained, Southern Nuclear said. These include approvals from the bankruptcy court, it added.

Toshiba is expected to make an initial payment of $300 million to Georgia Power in October.

In South Carolina, South Carolina Electric & Gas Company (SCE&G) said it had extended an interim agreement with Westinghouse in order to allow it to continue construction of units 2 and 3 at the V. C. Summer nuclear power plant while assessing its options for the site.

Westinghouse is building two 1250 MW AP1000 reactors at the site, with operations due to start in 2020.

Environmentalists have called on SCE&G to halt construction of the V. C. Summer expansion project because it is behind schedule and will prove expensive for consumers.

SCE&G owns 55 per cent of the V. C. Summer project, while state-owned utility Santee Cooper owns the other 45 per cent.

Santee Cooper is proposing two rate increases that would raise its customers' monthly electric bills by an average of $12.30 by 2019, largely to cover financing costs for the reactors. Those increases, which still need final approval, would be in addition to rate hikes in 2016 and 2017.

SCE&G's parent company, SCANA Corp., has said abandoning the project is an option. CEO Kevin Marsh told commissioners in April that other options include finishing one or both reactors. Roughly one-third of the project is complete.

Vogtle units 3 and 4 are expected to start operating in 2019 and 2020, adding 2.4 GW to Georgia Power's portfolio. They will be the first in the USA to use Westinghouse's AP1000 advanced pressurised water reactor technology.

Siemens closing Ontario factory

Dramatic changes and increasing competition in the global wind energy market has forced Siemens to announce the closure of its blade manufacturing plant in Ontario, Canada.

Siemens Wind Power Limited, part of Siemens Gamesa Renewable Energy, said that the closure would affect 340 employees at the plant in Tillsonburg. "This was a very difficult decision that was taken only after assessing all the options," said David Hickey, Head of the Siemens Gamesa Business in Canada. "The harsh reality is that, in order to remain competitive, we must constantly evaluate our global manufacturing footprint."

Siemens said that significant changes in global and regional markets, combined with physical limitations at the Tillsonburg plant, had driven the decision. Increased competition had driven a 66 per cent reduction in blade prices over the last seven years, while larger blade designs were increasingly in demand.

"The significant investments necessary to bring the plant in line with current market requirements would result in costs that could not be competitive in the global markets," Siemens said in a statement.

Solar expands in Brazil

■ 325 per cent growth in 2017-07-26
■ MME, EPE publish expansion plan

Renewable energy capacity in Brazil is growing steadily and installed solar photovoltaic (PV) capacity is expected to achieve growth of over 300 per cent this year.

According to the Brazilian Association of Photovoltaic Solar Energy (Absolar), installed PV capacity in Brazil will reach 1000 MW by the end of 2017, a 325 per cent surge over the end-2016 figure of 235 MW.

The growth in PV capacity this year has been achieved thanks to investments of Reals 4.5 billion ($1.3 billion), and the fact that the PV sector was not affected by Brazil's economic crisis, Absolar said.

Under Brazil's recently-released 10-year energy expansion plan, the government shows that up to 13 GW of solar PV could be installed in the country by 2026.

Overall, the energy expansion plan predicts that non-hydro renewable will account for 48 per cent of Brazil's energy mix by 2026, and that installed capacity will increase by 64 GW to 212 GW.

Funding outlined in the plan, published by the Ministry of Mines and Energy and Brazil's Energy Research Agency (EPE), contain about $306 billion for the oil and gas sector, $114 billion for electricity, including hydropower, and $10 billion into biofuels.

■ Brazilian regulator Aneel has approved eight renewable energy plants with a combined capacity of 148 MW for commercial or test operations. The plants include the 29 MW Sao Vicente wind farm and the 30 MW UFV Lapa 2 solar PV farm.

Australia split over energy recommendations

Dr. Finkel has made 50 recommendations

- HELE coal plants claimed to be cheaper
- Tesla to install 100 MW battery in 100 days

Syed Ali

A set of recommendations aimed at delivering a blueprint for the future of Australia's electricity market energy policy has split the country's Coalition government. The government has adopted 49 of the 50 recommendations made in a review led by Chief Scientist Alan Finkel but not the Clean Energy Target (CET) because of concerns it might prohibit investment in new coal fired generation.

The Finkel report, which did not rule out new coal fired power plants as being part of the nation's energy mix, analysed how the government could work to secure energy supply, drive down prices and cut emissions. Dr Finkel's final recommendation for a CET is expected to return to cabinet over the winter break, and to the party room, where conservative MPs have argued against new emissions regimes.

Commenting on the impasse, AGL Energy chief executive Andy Vesey and Origin Energy chief executive Frank Calabria said the government should embrace all 50 of Alan Finkel's recommendations to improve energy security, affordability and carbon abatement.

Calabria said the Finkel review provided a road map for energy security, affordability and carbon abatement that the private sector could use to modernise the system.

Vesey noted: "It is not a menu, it is 50 recommendations."

Acting Prime Minister Barnaby Joyce says the government should step in to build a new "clean" coal fired power station to help deliver cheap and reliable electricity to Australians if the private sector fails to stump up the finance.

New analysis, compiled by power and energy sector specialists GHD and Solstice Development Services, claims it would cost $2.2 billion to build a 1000 MW ultra-supercritical (USC) coal fired power plant and that it would deliver the cheapest electricity on the market.

The high efficiency low emissions (HELE) coal plant, which the Turnbull government has not ruled out funding, would produce electricity at $40-$78/MWh, compared with gas at $69-$115/MWh and solar at $90-$171. The 550-page technical study, commissioned by the Minerals Council of Australia and the COAL21 Fund, claims that clean-coal plants would drive down energy prices, and offers the Prime Minister an economic blueprint on the viability of new coal fired stations.

Former US Vice President and now climate change campaigner Al Gore argued that any move by the Australian government to subsidise coal fired power would be "crazy".

"Globally, the world is moving rapidly away from subsidies to fossil fuels," he said. "It would be odd if Australia went in the opposite direction and subsidised coal. It's impolitic of me to say it, but it would be crazy," he said.

Despite the uncertainty in government policy, states are still moving ahead with some significant clean energy projects.

In July the South Australia state government contracted Tesla to deploy a 129 MWh lithium ion battery storage system near Jamestown. The 100 MW battery is claimed to be three times more powerful than any other system in the world. The system being installed by Tesla and the French renewable energy group Neoen, is designed to provide power to the grid at times of generation shortfall, as well as providing stability to the network, day and night.

Tesla's billionaire boss Elon Musk has promised the system will be installed in 100 days from the signing of the contract or it will be free.

In a separate development, Photon Energy has started the development of a 316 MW solar power plant near Gunning in the state of New South Wales (NSW), Australia. When completed, it will become the largest planned solar power plant in the country.

Bangladesh accelerating energy diversification

The Bangladeshi government is accelerating its efforts to diversify its energy mix and enhance self-sufficiency in the energy sector.

In July it set a target to generate 2000 MW of electricity from renewable sources in three years.

Making the announcement in July, Nasrul Hamid State Minister for Power, Energy and Mineral Resources said: "We are working to increase power generation from renewable sources at a faster pace so it would meet at least 10 per cent of the total demand for electricity in 2020."

Currently, 447.51 MW of electricity comes from renewable sources, which is 2.87 per cent of the total power generation, according to the Ministry for Power, Energy and Mineral Resources.

The increase in renewables runs alongside a continuing move to grow fossil fuel electricity capacity to address a generating shortfall.

Last month the government said it will go ahead with the Rampal power coal fired plant after the World Heritage Committee of UNESCO withdrew its objection.

Prime Minister's Adviser on Energy issues Dr Tawfiq-e-Elahi Chowdhury said: "Construction of the Rampal 1320 MW coal fired power plant would be carried through with this new UNESCO stance."

The government also recently announced it will build a 150 MW diesel-based power plant. The plant, which will benefit from government subsidies, will be operated by the Bangladesh Power Development Board (BPDB).

Currently, around one dozen diesel-based power plants are operating in the country.

S. Korea moves away from coal and nuclear

South Korea aims to increase its use of renewables and gas for power generation after the new Moon Jae-in administration committed to reducing its reliance on fossil fuel and nuclear power plants.

Moon aims to increase the share of gas in the power generation mix to about 27 per cent by 2030, from 19 per cent today. For renewables the plan is to grow the share from 5 per cent to 20 per cent by 2030. The country currently generates two-thirds of its electricity from thermal coal fired power plants and nuclear reactors.

The decision to move away from coal and nuclear has been prompted by the desire to cut air pollution in cities and the Fukushima nuclear disaster in Japan.

In a policy report to President Moon Jae-in, who took office in May, the State Affairs Planning Advisory Committee said it will encourage big companies and small merchants to use renewable energy by offering financial incentives and other promotional packages.

By 2023, the government will require power utility firms with a generating capacity of 500 MW or more to generate 10 per cent of their electricity from renewable sources, according to the policy outline.

The so-called Renewable Portfolio Standard (RPS) mandates power utility firms to generate a certain amount of electricity from renewable sources. Under the RPS system, the proportion of electricity generated by renewables could rise to as high as 28 per cent by 2030, the report said.

The Moon administration has yet to come up with comprehensive measures to make up for the expected power production shortfalls caused by the shutdown of the nuclear and thermal power plants.

The decision to phase out coal and nuclear could, however, be less painful if demand slows, as some are predicting. A group of experts recently said electricity usage for the 2017-2031 period is forecast to be smaller than a previous government forecast that covers 2015 through 2029.

"The electricity demand for 2030 will likely reach 101.9 GW, down from the forecast of 113.2 GW made two years earlier," said Yoo Seong-hoon, an energy professor from Seoul National University.

- South Korean firm Solkiss plans to build the largest rotating floating solar park in the world, with a capacity of 2.67 MW. According to Solkiss, rotating solar parks are 22 per cent more efficient compared to conventional ground-mounted PV plants, while their efficiency is 16 per cent higher than that of water-fixed floating facilities.

Dutch aim for subsidy-free wind farms as offshore costs continue to fall

- Dong, Siemens embark on new UK study
- Svea Vind plans subsidy-free projects

Siân Crampsie

The Netherlands is to hold an auction for 700 MW of offshore wind energy capacity for developers interested in building the developments without subsidy support.

Minister of Economic Affairs Henk Kamp has announced that the tender for sites I and II of the Hollandse Kust Zuid zone to the west of the Netherlands will initially be opened on a subsidy-free basis.

If there is no interest in building the two 350 MW wind farm zones without subsidies, the tender procedure will go on as planned, Kamp added in a letter to Parliament.

The move follows recent offshore wind farm auctions held in Germany, where three out of four wind projects were won by developers on the basis of subsidy-free bids. A developer in Sweden has also recently announced plans to build offshore wind farms without subsidies, serving as further evidence of the falling costs of offshore wind technology.

The Dutch subsidy-free tender will assess bids on criteria such as developer expertise, design quality, wind farm capacity, social costs, and risk identification and analysis.

"Three years ago it was expected that up to €18 billion would be needed for the five wind farms off the coast of Zeeland and Holland," said Minister Kamp. "That included €4 billion for the offshore grid, necessary to get the power ashore. But now the costs have been more than halved and the expectation is that they will fall further."

And developers are continuing work to further drive down the costs of offshore wind.

In July, Dong Energy and Siemens Gamesa Renewable Energy joined forces with several UK academic institutions to establish a five-year working programme on offshore wind technology.

Working with the universities of Hull, Sheffield and Durham, Dong and Siemens Gamesa will examine current and future challenges of reducing offshore wind technology costs. Operations and maintenance will be a key theme of their research, Dong said.

"As we build more offshore wind farms in the UK, we are investing heavily in operations and maintenance activities, so understanding if these costs can be reduced by condition monitoring is key in our aim to reduce costs further," said Benj Sykes of Dong.

In Sweden, Svea Vind Offshore says it wants to build six new wind farms off the coasts of Gävle and Oxelösund, and plans to submit the permit application for the first 200 MW project later this year.

The wind farms will be built without subsidies, with factors such as good wind conditions and proximity to the shoreline helping to reduce costs, Svea Vind said.

The company believes that the cost of production from its wind farms will be less than €50/MWh.

The Netherlands has six offshore wind sites in the pipeline at the two Hollandse Kust zones: four at Hollandse Kust Zuid, and two at Hollandse Kust Noord. Each of the sites at the wind farm zones can accommodate 350 MW.

The tenders for the 700 MW Hollandse Kust Zuid zones III and IV are scheduled for 2018. The Hollandse Kust Noord tenders are slated for 2019.

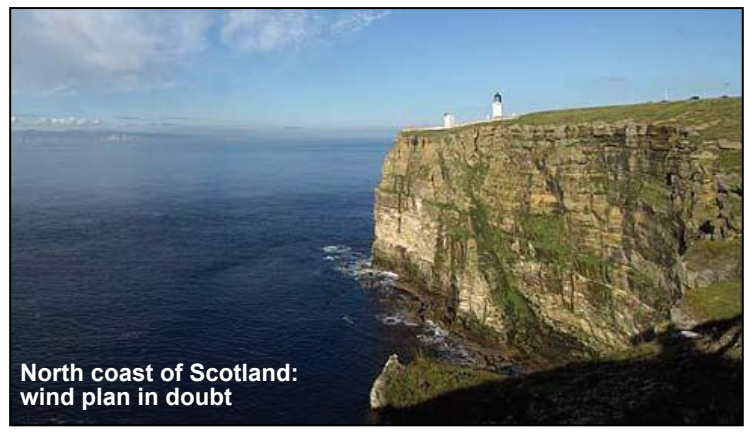
Floating wind farm project sinks

Plans for a floating wind farm demonstration project off the coast of Scotland are in doubt after the developer decided to call in the administrators.

Dounreay Tri has submitted a planning consent application to build a 10 MW scheme off the north coast of Scotland, near Caithness, demonstrating a semi-submersible foundation developed by its owner, Hexicon AB.

However Dounreay Tri has appointed accountancy firm French Duncan as administrators. Earlier this year the firm awarded the construction contract for its development to Global Energy Group and struck a deal with Scrabster harbour to service the scheme.

- Investors in the proposed Swansea Bay tidal energy scheme have put funding for the project on hold until the UK government makes a commitment to back it. The 320 MW scheme has planning permission but requires support in the form of a contract for difference (CFD) to make it financially viable.



North coast of Scotland: wind plan in doubt

EIB supports Spanish grid scheme

Plans to modernise Spain's electricity distribution networks and the digitisation of electricity meters have won the support of the European Investment Bank (EIB).

Spanish electricity firm Iberdrola has signed a €500 million loan agreement with the EIB that will help it to realise its so-called Star project, which aims to improve the quality of electricity services and supports smart grid development.

The company will initiate the project across several counties in the country including Aragon, Cantabria, Castilla-La Mancha, Castilla y Len, Comunidad Valenciana, Extremadura, La Rioja, Madrid, Murcia, Galicia, Asturias, Navarra and the Basque Country. It will install more than four million remotely controlled digital meters that can monitor consumer information in real-time.

Iberdrola has already installed 9.5 million digital meters in Spain, it said in May 2017, as well as the smart grid infrastructure to support them.

Critics jump on Hinkley cost rises

- Construction costs rise, delays likely
- Kepco in Moorside talks

The admission by EDF that construction costs of the Hinkley Point C nuclear power plant in the UK will rise, and that delays are also likely, has led to further criticism of the project.

EDF said last month that a review of the costs and timetable for the project – set to be the first new nuclear plant in the UK for two decades – indicated that project completion costs are now estimated at £19.6 billion, a £1.5 billion increase over previous evaluations.

It also said that the risk of deferral of delivery is estimated at 15 months for the first unit, and nine months for unit 2.

Separately, government figures have shown that consumers will be burdened with a higher bill than previously estimated for supporting Hinkley Point C.

EDF signed a contract for difference (CFD) with the UK government for Hinkley in 2013, guaranteeing that the plant would earn a minimum of £92.5/MWh for energy generated for 35 years.

Because of falling wholesale energy prices, it is now estimated that households could end up shouldering a £50 billion bill for the contract, more than eight times the 2013 estimate.

The latest data on the plant comes just a few weeks after the UK's National Audit Office (NAO), a spending watchdog, said that the deal for Hinkley struck between EDF and the UK government was "risky and expensive", and that the project would provide "uncertain strategic and economic benefits". Critics of the scheme have called for the government to put a stop to the project – and the UK's other planned new nuclear power plants – and invest in alternative energy technologies.

"Some may think nuclear is too big to fail, but no one can credibly say that Hinkley, or indeed other nuclear power plants, should go ahead without serious, public re-evaluation," said Nina Schrank, energy campaigner at Greenpeace UK. "Long before Hinkley is even finished, offshore wind will be producing far cheaper and safer power. The nuclear new build programme should be halted for better alternatives that will meet our energy needs and provide jobs in the regions."

However the government maintains that nuclear energy is required in the UK to help keep the lights on while reducing carbon emissions, and has pointed out that the CFD strike price awarded to Hinkley is in line with other low-carbon power plant deals.

The government says it is also continuing negotiations with Horizon and NuGen, which are planning new reactor construction projects in North Wales, Gloucestershire and Cumbria.

At the end of June, Korean firm Kepco confirmed that it is in talks with Toshiba over the purchase of a stake in NuGen's proposed Moorside nuclear power project in Cumbria.

Toshiba's financial difficulties have cast doubt over the viability of the 3.8 GW Moorside project and NuGen announced in May that it was seeking strategic investors to enable it to keep the project afloat.

Kepco is seen as a likely partner in the project, but will want to use its own reactor technology at the site, rather than that of Westinghouse, Toshiba's bankrupt US subsidiary.

Dong moves ahead with Asnaes conversion

Dong Energy is moving ahead with plans to convert a coal fired power plant in Denmark to biomass firing after concluding heat and power supply agreements with customers.

The utility is to convert the Asnaes power station near Kalundborg – one of the largest power plants in the country – to fire on wood chips from late 2019 onwards. It will sell steam, district heating and power to customers including Novo Nordisk, Novozymes and utility Kalundborg Forsyning, for 20 years, it said.

Dong announced in February 2017 that it would no longer use coal at any of its power stations beyond 2023. It has already reduced the use of the fossil fuel by 73 per cent since 2006 through co-firing at some of its plants and carrying out full conversions at others.

Conversion of the Asnaes plant will start in the coming weeks and Dong has selected Finland-based Valmet to supply the biomass plant, it said. Asnaes power station currently has two coal-fuelled units – Unit 2 with a capacity of 142 MW power and 193 MWth district heating and process steam, and Unit 5 with a capacity of 640 MW power and 308 MWth district heating and process steam.

The conversion from coal to wood chips at Asnæs will result in an annual reduction in CO_2 emissions of around 800 000 tonnes. Pharmaceutical firm Novo Nordisk said that the deal with Dong would enable its Kalundborg production unit to become carbon neutral.

Wind wakes up in Saudi Arabia

- RFP will open in August
- Saudi Aramco commissions first turbine

Siân Crampsie

Saudi Arabia is preparing to host its first utility-scale wind energy project.

The Kingdom has issued a request for qualification (RFQ) for a 400 MW wind farm in Dumat Al Jandal, in the Al Jouf region.

It has also seen the commissioning of its first wind turbine, a GE unit installed at a Saudi Aramco facility in Turaif, in the northwest of the country.

The RFQ for the Dumat Al Jandal facility was opened in mid-July by the Renewable Energy Project Development Office (REPDO) of Saudi Arabia's Ministry of Energy, Industry and Mineral Resources. The RFQ window will close on August 10 and the qualified companies will then proceed to the request for proposals (RFP) stage.

That process is scheduled to start on August 29 and close in January 2018.

The Dumat Al Jandal wind project is part of round one of the National Renewable Energy Program (NREP), the other part being the 300 MW solar photovoltaic (PV) scheme in Sakaka, for which an initial tender was issued in April 2017. The winning bid for the solar project will be announced in November 2017.

"The release of Dumat Al Jandal's wind project RFQ, and upcoming RFP next month, ensures that we remain on course to tender 700 MW in round one this year," said Khalid Al-Falih, Minister of Energy, Industry and Mineral Resources. NREP seeks to have 3.45 GW of renewable energy capacity by 2020 and a total of 9.5 GW by 2023. The wind and solar projects will secure 20-year and 25-year power purchase agreements (PPAs), respectively.

The Saudi Aramco wind turbine, a GE 2.75-120 unit, will provide energy directly to the firm's Turaif facility, enabling a reduction in the consumption of diesel at the plant, and will also feed energy to the grid.

Abdulkarim Ghamdi, Saudi Aramco executive director for Power Systems, said that the turbine "was the start of something new" in the country. "Wind energy offers potential to provide new energy in the kingdom's energy mix and enhance power generation efficiency, thus delivering on the core objectives of Vision 2030," Ghamdi said.

G20 lacks climate stewardship, says new index

Countries in the G20 are still a long way from demonstrating responsible stewardship in the area of climate protection, a new report has found.

The G20 Climate Change Performance Index (CCPI), produced by Germanwatch, ranks countries based on their emissions, energy use, renewable energy and climate policy. Its latest report shows that the USA and Saudi Arabia trail far behind countries such as Italy, Brazil and France in climate stewardship.

It also states that no country in the G20 is on track to meet the Paris climate goals.

"It's time for the world's richest economies, accounting for over 80 per cent of global emissions, to step up their game on climate action," said Wael Hmaidan, Executive Director of Climate Action Network (CAN), co-publisher of the study. "If we are to realise the goals of the Paris Agreement we need countries to get down to the business of serious implementation, to come prepared to assess their collective progress in 2018 and trigger a process to increase climate ambition by 2020."

Germanwatch said that Italy is the unexpected leader in the G20 ranking, while Brazil is placed second. Key factors in Italy's success are its downward trend in per capital greenhouse gas emissions and strong growth in renewables.

China is ranked 12th due to its immense growth in energy use and emissions in the years up to 2014. The USA occupies second to last place because there are no recognisable attempts at national level to tackle either the very high CO_2 emissions or the immense energy use per capita.

China's ranking is expected to improve because of its efforts to limit the growth of greenhouse gas emissions.

"Particularly promising are the developments in some of the major emerging economies such as Brazil or India," said Prof. Niklas Höhne from the NewClimate Institute. "Brazil has achieved crucial advancements in reducing deforestation over the last years, which need to be kept going within the present challenging political debate.

"India is seeking to skip traditional stages of development by favouring renewables over coal and electric vehicles over gasoline and diesel. Both countries are moving in the right direction – yet climate policies and international climate finance needs further support."

Nuclear plant progresses in UAE

The construction of the first nuclear power plant in the UAE is 75 per cent complete, according to the Emirates Nuclear Energy Corporation (ENEC).

ENEC has announced that construction of units 3 and 4 at the Barakah nuclear energy plant is now more than 50 per cent complete.

ENEC has now set in place unit 3's Reactor Containment Building (RCB) liner dome section, installing the roof of the structure which now houses the Reactor Vessel (RV), a statement said.

Unit 3 is now more than 62 per cent complete and work to pour the concrete and complete the RCB is progressing. The RCB is expected to be completed in the first quarter of 2017, roughly a year after similar work was concluded on Unit 2, the statement said.

The Barakah facility is scheduled for completion in 2020, with construction having started in 2012.

A Korea Electric Power Corporation (Kepco) led consortium is building the four 1400 MW nuclear reactors, which will provide around one quarter of the UAE's electricity needs when complete.

AfDB supports Ngozi

- Up to 100 MW at Ngozi
- Plant will be template for the future

Tanzania is taking a step forward in its plans to transform its economy with the development of a geothermal energy project, the African Development Bank (AfDB) has said.

The Climate Investment Funds (CIF) has approved funding of $21.7 million to finance the country's efforts to exploit its geothermal energy capacity. The project is a key part of Tanzania's efforts to develop an affordable and sustainable source of baseload energy to underpin its economy.

The funds will support development of the Ngozi geothermal steam field in southwestern Tanzania. The project will showcase the potential for the application of geothermal energy in the country, AfDB said.

"We are assisting in the first step in the transformation of Tanzania's energy sector, a transformation that is being built on a sustainable energy source," said Leandro Azevedo, AfDB's Senior Climate Finance Officer and CIF Coordinator.

"Developing geothermal capacity in Tanzania is an essential part of that transformation and we hope that this project's success will lead downstream to the installation of a 100 MW power plant and help create the conditions for the development of other geothermal sites in the country," he added.

The project involves conducting exploratory test drilling and installing the required steam gathering infrastructure in the Ngozi geothermal site. The project is funded under the CIF's Scaling-up Renewable Energy Program (SREP) and will receive $5 million as a loan and $16.73 million in grant resources to be implemented by AfDB.

This SREP highly concessional finance will be instrumental in mitigating the high-risk nature of geothermal prospection and field development. Ultimately, the project is also expected to have transformational effects not only on Tanzania and its energy sector but also more broadly in the African Rift Valley region.

The proposed 100 MW Ngozi plant would generate 823 GWh per year, improving Tanzania's energy security by reducing its reliance on imports from neighbouring countries.

The project will also contribute downstream to capital mobilisation from both public and private investors by creating an enabling environment for unlocking both public and private funds, AfDB said. The total contribution expected from private sector is estimated at $300 million.

Special Supplement

Investing more energy in cyber security

With digitalisation and decentralisation becoming more widespread in the energy sector, cyber attacks are on the rise. As a global company with expertise in operational technology, Siemens is well placed to deliver cyber security solutions to the industry. **Junior Isles**

Although there has been a growing awareness of the importance of cyber security, the seriousness of the threat was thrust into the global spotlight in May with the Wannacry ransomware attack.

It was reportedly the biggest cyber attack in history, with one security software supplier observing 57 000 infections in 99 countries. Notably, the UK's National Health Service (NHS) was severely affected, including 40 hospital trusts.

Operations and appointments were cancelled and ambulances diverted. Hackers demanded payment to restore access to vital medical records. Other big names such as Spanish telecom giant Telefonica and international shipper FedEx Corp in the US were also infected.

The power sector did not escape damage. WannaCry attacked computers at the West Bengal power distribution company in India. Officials from West Bengal State Electricity Distribution Company (WBSEDCL) detected the malicious software (malware) at four of its offices.

The WannaCry attack served as an important reminder for key infrastructure sectors, such as power and energy, to strengthen their cyber defences.

Siemens has long recognised the gravity of the danger posed by the growing cyber threat to the power sector. Leo Simonovich, Vice President of Global Cyber Strategy at Siemens, noted that it is a "top-three issue" for customers. "Among all sectors, energy is the most attacked," he said.

The threat has largely been brought by digitalisation. Digitalisation in the energy sector brings a convergence of information technology (IT) and operational technology (OT) connectivity so that data can travel from the field to the control room to the enterprise network. The crossover between IT and OT has underscored the need for a unique set of solutions.

According to a recent independent study conducted by the Ponemon Institute, the OT side is significantly more vulnerable to a cyber attack than the IT side, and breaches have a much bigger impact. "OT, which is everything outside the enterprise network, is the new frontier for the cyber risk." Simonovich noted that attacks against OT have increased six-fold over the past few years, from five per cent to 30 per cent today.

The Ponemon study revealed that nearly 70 per cent of US oil and gas cyber managers said their operations have experienced at least one security compromise within the past year, resulting in the loss of confidential information and OT disruption.

This upsurge in attacks led Siemens and Atos, a global leader in digital services, to increase the scope of an alliance the two companies formed in 2011, which creates one of the largest strategic relationships between a global engineering company and a global IT provider. The two companies are now leveraging their portfolios to help US utilities and the oil and gas industry establish an integrated and seamless first line of defence against cyber-attacks.

The cyber risk is greater on the OT side than to IT for several reasons. As legacy assets are digitalised, connectivity also grows. This leads to a larger attack surface that is harder to secure. Also, attackers are looking for new areas to penetrate, where they can extract additional cost out of the system.

"When we think about the impact of an attack against the OT environment, things like ransomware become a lot more powerful," said Simonovich. Finally, increased competitiveness in the power and oil and gas sectors has led to "lots of different bad actors looking to go after the environment".

Simonovich insists, however, that greater connectivity also creates endless opportunities for optimising operations. And it gives an organisation greater visibility into its assets and operations, and therefore greater ability to detect and respond to an attack.

It is safe to say that most companies face 2-3 attacks a year, according to Simonovich. "This means that the possibility of a successful attack is 100 per cent. Companies must develop the capability to detect, conduct security analytics, respond, and quickly recover. Business continuity is imperative," he said.

Connectivity and interconnectivity bring increased risk across the whole energy value chain – from upstream to distribution and retail. Data flows from the field to the control room and to the enterprise network. Key for companies who want to strengthen their defences against cyber attacks is not only securing the data that sits in the control room environment but also securing the data at the edge.

Simonovich explained: "You have to think about what data needs to travel where." He cited the December 23, 2015 cyber attack that left homes in Western Ukraine without power for several hours. "For five hours the operator did not know he was experiencing a cyber attack. As a result, 225 000 homes lost power in the middle of winter."

One year later Ukraine was attacked again. On December 17, 2016, a power outage affected Kiev just before midnight, resulting in an hour-long blackout. Ukrenergo said the incident led to the loss of about one-fifth of Kiev's power consumption.

Cyber security is not just about reacting to isolated incidents. When business continuity is critical, such as with power and electricity supply, it is just as critical to protect against the persistent threat of cyber attacks. As

Simonovich noted, the Ukraine attacks affected different parts of the value chain. "To be able to detect an attack that is happening in the utility environment, you have to know what is normal, which is based on how your assets are performing. You have to be able to do security analytics at the asset level, the SCADA level and the network level. When you can do all three at the same time, you have true insight. At Siemens, we know this from experience," he said.

"Global companies are looking for 24/7 coverage, including OT dedicated monitoring," Simonovich noted. "You can't simply drop IT solutions into the OT environment. The protocols are not standard. Engineering specifically for OT means you can follow customer needs and deploy tools – everything from intelligence, to network monitoring to anomaly detection – in order to quickly detect and stop attacks from happening." He added: "Combining the asset-level data with network-level data means customers can gain deep insights into the behaviour of their assets across the value chain as well as down the technology stack."

In a move to bring cutting-edge cyber defence for OT to electric utilities and the oil and gas industry, Siemens recently entered into a strategic partnership with Darktrace, a leading machine learning company for cyber security. Both companies bring specific expertise to the partnership.

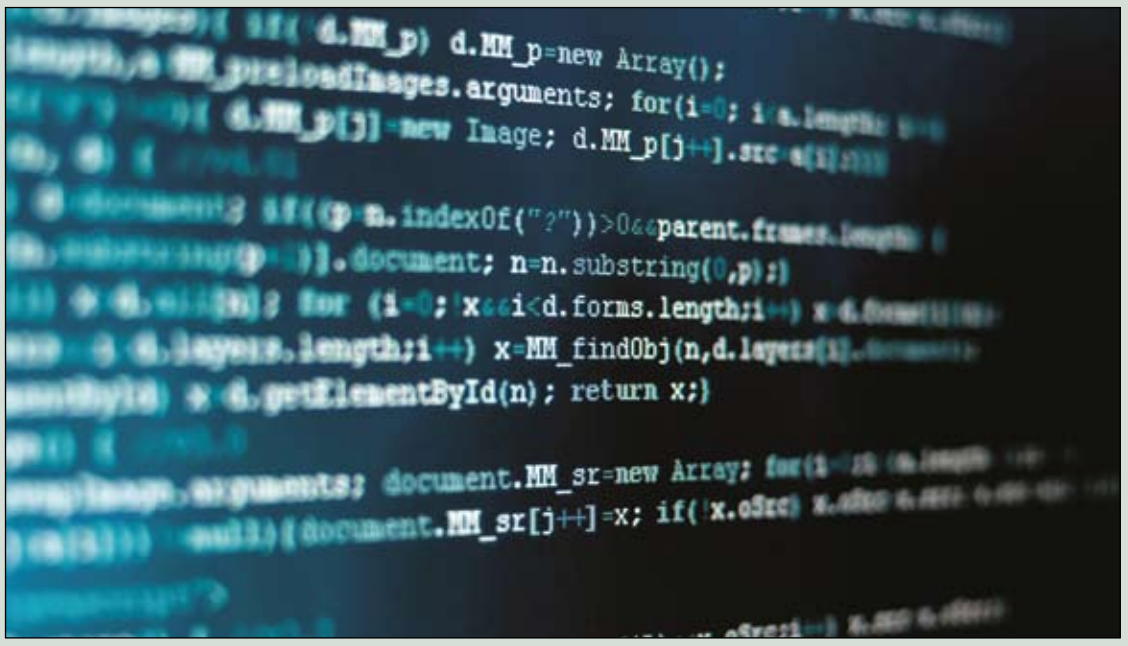
As an industrial technology provider, Siemens has an inherent and holistic understanding of how to manage business risk by minimising cyber risks in complex operating environments. It brings deep domain know-how and solutions for OT cyber, including security program design, security lifecycle management, plant security monitoring, and incident response.

Leveraging advances in machine learning and probabilistic mathematics, Darktrace's Industrial Immune System platform can detect and remediate in-progress cyber threats at their nascent stages. By learning the 'pattern of life' for every network, device, and user across both OT and IT networks, the companies claim the Artificial Intelligence (AI) algorithms can identify and automatically take action against emerging attacks that other tools miss. Simonovich commented: "We're very excited about teaming with Darktrace. Together we can help detect attacks like Wannacry well in advance and stop them."

In addition to delivering cutting-edge technology, Simonovich says utilities want "first line of defence measures". The industry, he says, is facing a perfect storm: although digitally connected, it has not yet addressed many fundamentals. "Customers are looking for partners to help them navigate along their cyber journey – build a strategy that addresses foundational issues such as cyber asset management, vulnerability management and monitoring solutions."

When building a cyber security programme, the first step is usually to assess where the utility or organisation is on the maturity curve.

Simonovich explained: "The first thing I ask a customer is: Do you have a strategy? Have you dealt with the fundamentals? Have you transformed their security environment? We then look at how to begin monitoring and detection – smartly, aligned with the business objectives and priorities. By monitoring in blocks, based on where the risk is and the customer's assets prioritisation, we can come up with a smart strategy for connectivity, monitoring and response.



It is critical to think about what data needs to travel where

Simonovich noted: "Technology will not solve the problem on its own. A holistic approach designs the right kind of strategy that technology supports. In a world where you have a decentralised operating model, in which asset owners rely on third parties to provide their operation and their IT, the weakest link can be the cause of a major incident. We look to play a critical role in helping to 'lift the middle' and address weak points head on."

"Lifting the middle" is becoming an increasingly important business, especially given the increasing prevalence of distributed energy. "Our customers know that cyber security is a major imperative and that they need to be proactive," said Simonovich. "They know we are here to help them in times of need. But it is important for them to be proactive in building up their defence measures. We can

A more proactive approach

A shift in the approach to cyber security is taking place in the power generation sector, particularly as more sophisticated cyber threats are uncovered. While traditional cyber security offerings based on a collect-and-report model are still in use, more proactive approaches to information gathering, usage and reporting are also being deployed to enable advanced analytic capabilities and interactive reporting. In addition, these new approaches allow for tailoring the exact scope of the data gathering and analysis to meet the needs of the customer.

The drivers for these changes are primarily the same, regardless of the region where the power generation assets are operated. Regulations and standards, as well as a desire for more tailored cyber security solutions were the common requirements for the new concepts.

For example, in the US, this change is partially driven by the newer industry standards, such as those set forth by the North American Electric Reliability Corporation (NERC) with the Critical Infrastructure Protection (CIP) V6 rule. Prior revisions of standards like NERC's focused more heavily on becoming compliant as an end goal, whereas newer revisions consider compliance the starting point, and focus on staying compliant.

But regardless of whether the customer follows CIP, VGB PowerTech, National Institute of Standards and Technology (NIST), National Electronic Security Authority of the United Arab Emirates (NESA), or other industry standards: the old way of doing things is based around the idea of 'getting to compliance', whereas the new requirement is focused on 'living in compliance'.

To address this new paradigm, Siemens has developed its cyber security offerings to the energy industry in a central monitoring, alerting and reporting system concept called Cyber Security Center (CSC). Using industry standard tools and processes, the Siemens Cyber Security Center meets the requirements of a modern cyber monitoring system by combining Security Configuration Change Management (SCCM), Security Intrusion Event Monitoring (SIEM), a Network Intrusion Detection System (NIDS) and an advanced dashboard.

In addition to creating a "single-pane-of-glass" view of the cyber solution, the CSC also provides the ability to review the gathered information in a variety of channels. The central dashboard resides within the DCS itself. It can be made visible within the SPPA-T3000 control system's workbench as a standard HMI graphic. And, it can be accessed from both the plant DMZ and the customer OT/IT security teams via the corporate network, all controlled by the customer's security staff.

A major US utility customer was the first to deploy the CSC solution in the US market. Their cyber analysts met with Siemens during the Customer Factory Acceptance Test and spent several days going over the product in great detail, resulting in a number of customisations to the dashboards and reporting capabilities to meet their specific internal requirements.

Later, during site integration and testing, the utility's resident site security engineer spent several more days testing and evaluating the product using actual data being generated by the power plant. Further customisations were made to fine-tune the output. At the end of the project, the entire solution was copied off and merged into a template so that it could be installed by the utility on future projects.

The utility's cyber experts are required to monitor and review daily the logs generated by the CSC, and any incidents are captured, reported on and mitigated as quickly as possible. Their approach to making the CSC dashboard directly visible to their resident site security engineer guarantees that they can do their job without having to constantly walk out to the DCS and review the logs locally. Additionally, in the event they are off-site or working remotely for any reason, these same dashboards can be accessed from any location.

This tailored approach is central to the product development strategy for Siemens' cyber offerings, not only for the current portfolio, but for the future as well. Each iteration of the CSC is representative of a phased approach whereby each phase builds upon the last to enrich the value of the offering. For example, Phase 1 was simply designed to meet the requirements of the regulatory market; Phase 2 updated offerings to be more flexible in meeting each customer's individual requirements; and Phase 3 extends the solutions beyond the Siemens products to meet all of the customers' needs in the OT cyber space.

To do this Siemens is partnering with a number of top-tier technology providers to create a vendor-agnostic, solution-specific cyber offering that customers can deploy across their entire fleet, regardless of vendors or specific products.

Tackling headache-inducing topics such as cyber asset management, network intrusion detection, vulnerability auditing and reporting, and multi-tiered risk assessments, Siemens is acting as the integrator and solution provider for these technologies, as well as providing a Managed Security Services offering to help customers who need assistance in the OT Cyber environment.

Simonovich: most companies face 2-3 attacks a year

certainly provide remediation measures, but they must take a step back and ask themselves: 'What is my strategy?'"

Simonovich advises customers to place IT-savvy employees at all levels of the organisation, from the boardroom to the plant operator.

While companies are keen to take advantage of the value that digitalisation can bring, some are wary of the accompanying risk. It is therefore important to assure them that the products and systems they are introducing are inherently safe. According to Siemens, secure products are its foundation. Every product business line has a product security officer that looks at the full lifecycle, from design all the way through to disposal.

"Our customers initially fear greater connectivity because they think this increases their risk, but in reality it provides them with insight," said Simonovich.

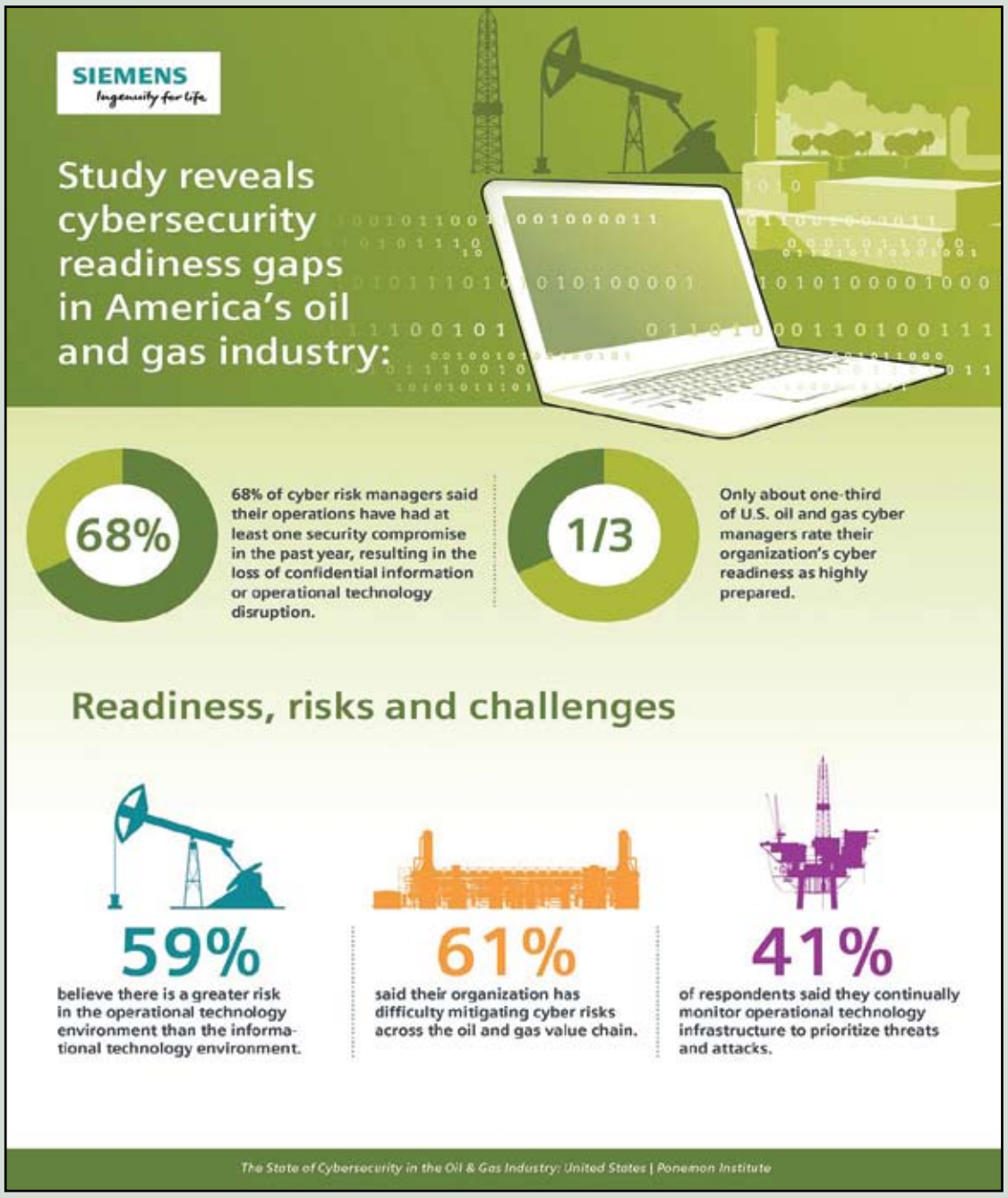
He says that on the OT side 70 per cent of attacks are due to insider threats and that the average number of days a piece of malware sits on the OT side ranges from 200-400 days. "Once connected, you can have visibility into what's happening. If a piece of malware is brought into a power plant by a contractor, you can detect it. Connectivity equals insight, and that's power."

Determining whether the cyber security measures that have been put in place are a success, however, is a moot point. Simonovich says, it is not a case of simply assuming that they must be working because the organisation has not suffered a breach.

He said: "First it starts with looking at your risk appetite, assessing your residual risk and everything in between, and then figuring out how to build up your matrix. You can't be fool proof; attacks will happen. The question is: understanding what the risk profile looks like and determining whether cyber risks have been minimised. That's what we help our customers figure out – defining and controlling those which are technical, and those that are more to do with strategy and process."

As cyber threats change and the nature of cyber breaches evolve, staying on top of changing risks and types of attack is imperative. Today, attackers have no geographic boundaries. Simonovich believes that what energy companies need is an OT provider that has global coverage, and preferably one that has secured its own environment and understands the threat.

Having experienced a cyber attack early on, Siemens shares its own experience with energy companies. "Cyber security has long been important to Siemens, but Stuxnet really demonstrated the need to transform our cyber security operations, to build up our defenses even further." Siemens is a diverse company with a broad geographic footprint, in 190 countries, with over 50 business units. "That global presence gives us visibility across our installed base. And, through our partnerships and participation with communities, we can quickly detect and understand what is happening around the globe."



The Ponemon study revealed that nearly 70 per cent of US oil and gas cyber managers said their operations have experienced at least one security compromise within the past year

He stressed the importance of identifying an attack as soon as it takes place. While knowing who has launched an attack is useful, it is more important to understand the methods they used to get in, and put a strategy in place against those measures.

Simonovich commented: "The reality of Wannacry is that basic cyber hygiene could have prevented much of the damage. That's why the first thing we tell our customers is to focus on the fundamentals and then address the more advanced issues. But you have to do both."

He concluded: "There is no silver bullet that will protect anyone from a cyber attack. Security requires developing a strategy and sticking with it. It's the journey not the destination."

Connectivity equals insight: Once connected, operators can have visibility into what is happening

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EDF seals New NP deals

Mitsubishi Heavy Industries (MHI) is to take a 15 per cent stake in French nuclear reactor business New NP after signing a binding agreement with utility EDF.

The deal marks a significant step forward in the restructuring of France's nuclear energy sector, involving the break up of Areva Group's activities and the acquisition of its nuclear reactor business by EDF.

EDF has also agreed to sell a five per cent stake in New NP to French nuclear engineering company Assystem for €125 million. At the same time, the French utility is continuing talks with other potential strategic investors, it said.

EDF agreed in 2015 to buy a controlling stake of up to 75 per cent in Areva's reactor unit as part of government plans to rescue the struggling engineering firm. MHI announced in January 2017 that it would acquire a five per cent stake in New Co, which combines Areva's nuclear fuel cycle activities, for €250 million.

Jean-Bernard Lévy, Chairman and Chief Executive Officer of the EDF Group said: "The entry of new partners, both leaders in their activities, in the shareholding of New NP marks the achievement of a key milestone in the restructuring of the French nuclear industry. This demonstrates the attractiveness of our projects and expertise to the other players of the global nuclear industry."

EDF said in a statement that it and its strategic partners would acquire their respective stakes in New NP simultaneously, and that they were targeting the end of 2017 to complete the deals.

At the end of June, EDF said that French nuclear watchdog ASN had issued a positive opinion on the reactor vessel at the Flamanville 3 nuclear power project.

The ASN's ruling is a precondition for the French government's plan to inject €4.5 billion into Areva to shore up its finances.

ASN head Pierre-Franck Chevet told French media that the reactor vessel is fit for service despite the weaknesses in the steel of the cover and the bottom discovered in 2014. However, EDF will have to replace the vessel cover by 2024, he said.

AES, Siemens exert influence in storage sector

Technology firms are keen to bolster their expertise and technology portfolios to gain market share in a rapidly expanding sector.

Siân Crampsie

AES and Siemens have become the latest companies to seal a strategic deal in order to gain traction in the growing global energy storage market.

The two companies have announced an agreement to create a new global energy storage technology services company, called Fluence, that will combine their respective expertise, experience and technologies in the energy storage field.

Fluence will combine AES's Advancion technology with Siemens' Siestorage platform to meet the needs of the rapidly changing and growing energy storage market, Siemens and AES said in a statement.

"The company will empower customers around the world to better navigate the fragmented but rapidly growing energy storage sector and meet their pressing needs for scalable, flexible, and cost-competitive energy storage solutions," they added.

Siemens and AES will each hold a 50 per cent stake in Fluence, which will have global headquarters in Washington, DC, and additional offices in Erlangen, Germany. Fluence will operate independently of its parent companies.

"As the energy storage market expands, customers face the challenge of finding a trusted technology partner with an appropriate portfolio and a profound knowledge of the power sector. Fluence will fill this major gap in the market," said Ralf Christian, CEO of Siemens' Energy Management Division. "With the global reach of an experienced international sales force as well as Siemens' leading technology platform Siestorage at its disposal, Fluence will be perfectly equipped to serve this very interesting market."

Together, Siemens and AES have deployed or have been awarded 48 projects totaling 463 MW of battery-based storage across 13 countries, including the world's largest lithium-ion battery-based energy storage project near San Diego, California.

The deal between the two global firms follows other recent agreements in the market, including Aggreko's acquisition of Younicos, and Wärtsilä's deal to buy Greensmith Energy Management Systems Inc.

In July, Aggreko announced plans to acquire Younicos, a battery integration specialist, for £40 million. It said that it would leverage Younicos' "compelling" capabilities through its global footprint and that the purchase would enable it to help its customers to reduce their energy costs.

"Together we are a powerful combination; our scale, fleet and global presence, coupled with a smart energy capability, will allow us to open up new markets and provide our customers around the world with a reliable, cheaper and cleaner source of energy," said Chris Weston, Aggreko CEO.

Wärtsilä said in July that its deal to buy Greensmith had closed.

The Finnish firm believes that the deal will enable it to rapidly expand its footprint in the energy storage market globally and offer standalone energy storage solutions as well as hybrid plants.

"Greensmith brings an unmatched track-record of software and systems integration capabilities, having delivered a third of all 2016 energy storage installations in North America," said Javier Cavada, President of Wärtsilä Energy Solutions. "Wärtsilä's global footprint with an extensive sales and service network, besides its proven EPC expertise, will create significant synergies and growth."

A2Sea finds new home

- GeoSea buys installation specialist
- A2Sea will continue as key Dong supplier

Dong Energy says that the sale of its offshore wind installation business, A2Sea, will enable it to maintain its focus on its core business.

The Danish utility and its partner, Siemens, have agreed to sell A2Sea to GeoSea, a unit of Belgian dredging and marine engineering group DEME for an undisclosed sum.

Dong still expects A2Sea, which specialises in the installation of offshore wind turbines and foundations, to remain a key supplier for its pipeline of projects. A2Sea will continue to operate out of Denmark, Dong said in a statement.

Luc Vandenbulcke, Managing Director of GeoSea, said: "The activities of A2Sea represent a strong and complementary fit with GeoSea's operations.

A2Sea has installed over 1500 turbines and 400 foundations

The combined organisations will be well positioned to provide a broader range of integrated services and solutions to offshore wind energy customers. We continue to build on existing customer relationships and ensure a safe and reliable delivery of current and future projects."

A2Sea has installed more than 1500 turbines and 400 foundations, it said. It is currently installing turbines at the Dudgeon and Race Bank offshore wind farms in the UK.

Future projects in the pipeline include Arkona, Hornsea Project One, Horns Rev 3 and East Anglia One.

Dong and Siemens have owned A2Sea since 2009 and the installation specialist enabled both companies to consolidate their position in the offshore wind sector.

The transaction requires the approval of regulatory authorities and is expected to be completed in the third quarter of 2017, Dong said.

Kite secures £2 million investment

The Scottish Investment Bank (SIB) has joined E.On, Schlumberger and Shell Technology Ventures with an investment in innovative technology group Kite Power Systems.

SIB, the investment arm of Scottish Enterprise, has pledged a £2 million equity investment in Kite, which is developing a new kite power technology from its base in Scotland.

Kite Power Systems said that the investment would enable it to accelerate its commercial development plans and the deployment of a deepwater offshore wind energy technology.

Kite's technology consists of two kites that can fly up to an altitude of 450 m. Both kites are attached by tethers to a winch system that generates electricity as it spools out.

The firm says that the technology has the potential to transform the global offshore wind generation market because it is cheaper to manufacture and requires less construction and installation materials than conventional offshore wind farms. It is currently manufacturing and assembling a 500 kW demonstration model.

Scottish Economy Secretary Keith Brown said: "Scotland has a long and proud history of innovation and Kite Power Systems' pioneering approach to harnessing wind energy shows great promise. This £2 million investment from the Scottish Investment Bank will enable it to expand further and demonstrate the latest iteration of its kite power technology in Scotland."

Kite Power Systems has been testing a 40 kW pilot model in Scotland and has secured planning consent for the 500 kW demonstration, which it plans to deploy in August 2017.

Eventually the company plans to build an array of 500 kW kites, and develop a 3 MW onshore system for testing.

Americas

Elecnor orders Vestas units for Larimar II

Vestas says it has received an order from Elecnor to supply of 48.3 MW of wind turbine capacity for a project in the Dominican Republic.

Vestas will deliver and install 14 of its V117-3.45 MW wind turbines at the Larimar II wind farm in the region of Enriquillo. Deliveries will start in early 2018, with commissioning scheduled for the third quarter of that year.

Elecnor is building the wind farm under an $89.1 million (€77.6 million) turnkey contract from Spanish utility Empresa Generadora de Electricidad Haina SA (EGE Haina).

EDF awards contract for Copenhagen, NY, project

EDF Renewable Energy has placed orders with Vestas and Renewable Energy Systems (RES) for the 80 MW Copenhagen wind project, it has announced.

Vestas will supply its V110-2.0 MW wind turbines for the project, while RES was awarded the contract for balance of plant construction.

Located in Lewis and Jefferson counties in upstate New York, USA the project benefits from a 15-year Power Purchase Agreement with Narragansett Electric Company, a subsidiary of National Grid.

Construction on the project will start this month and the plant is scheduled to start commercial operations in November 2018.

Korean firms win Guam solar-storage projects

Korea Electric Power Corp (Kepco) and Hanwha Energy Corp have been awarded contracts to build separate solar farms equipped with energy storage in the US territory of Guam.

Kepco and Hanwha have signed contracts with the Guam Power Authority to build the 60 MW solar farms, which are due to start operating at the end of 2019.

Kepco has signed a $200 million deal to build a 60 MW solar farm and 42 MWh energy storage unit in Mangilao, northern Guam. Hanwha will build a solar farm and 65 MWh energy storage facility in Guam's Dandan region.

Wärtsilä signs O&M deal

Wärtsilä is to take over full operations and maintenance (O&M) of the Central Térmica Parque Pilar power plant located in the Buenos Aires province, Argentina.

The Finnish firm has signed a 10-year O&M deal with Pampa Energia SA, which is building the 100 MW power plant.

The baseload facility is powered by six Wärtsilä 50DF multi-fuel engines and will run primarily on natural gas, with heavy fuel oil as a back-up fuel.

The installation will be continuously remotely monitored, and the received data serve as the basis for Wärtsilä to constantly evaluate the power plant's performance in order to proactively mitigate any operational deviation, thus preventing and minimising unexpected downtime.

Wärtsilä will handle risk management and provide Pampa Energia with performance and lifecycle cost guarantees, ensuring efficient and optimised operations. The scope of services includes personnel for operations, spare parts and a full range of maintenance services, from scheduled service activities to predictive and unscheduled maintenance.

Asia-Pacific

Sabah solar project takes shape

SPIC Energy Malaysia has placed an order with JA Solar for the supply of photovoltaic (PV) modules for a 50 MW solar power plant in Sabah, Malaysia.

JA Solar will supply its Percium mono modules with improved anti-PID function and reduced light induced degradation rate for the project, which will be the first of its kind in Malaysia.

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

Jacobs wins Australia wind farm role

Powering Australian Renewables Fund (PARF) has appointed Jacobs Engineering Group Inc. as project manager and owners engineer for a proposed 200 MW wind farm in western New South Wales, Australia.

The A$450 million ($356 million) wind farm will comprise 58 turbines and is part of plans by PARF to develop, own and manage 1000 MW of large-scale renewable energy infrastructure assets and projects.

Equis places Tolo 1 order

Equis Energy has placed an order with Siemens Gamesa for 20 wind turbine units for the Tolo 1 wind farm project in Indonesia.

Siemens Gamesa will supply its gearless SWT-3.6-130 wind turbines for the project, which will be located in Jeneponto on the south coast of the central Indonesian island of Sulawesi. For the installation work, Siemens Gamesa Renewable Energy is working in consortium with one of the largest Indonesian construction companies PT PP (Persero) Tbk.

The turbines will be installed in late 2017 for commissioning in early 2018 according to Equis, an independent power producer. Equis has signed five-year contracts with Siemens Gamesa for engineering, procurement and construction (EPC) as well as operations and maintenance (O&M).

Japan plans offshore capacity

The government of Japan's Ibaraki prefecture has selected a consortium of Hitachi Wind Power Co Ltd and Windpower Energy Group Co Ltd for the development of the 93.6 MW Kashima Port South wind farm in Japanese waters.

The consortium was selected after the reopening of the bidding process for the ¥49 billion ($430 million) project as the previously picked developer, Marubeni Corp., withdrew in January. Marubeni said at the time that the scheme was no longer considered to be profitable.

The proposed offshore wind farm will consist of 18 Hitachi turbines of 5.2 MW each, which will be installed near the Kashima Port. The machines will use 66.5 m blades made by LM Wind Power.

Europe

Nordex turbines for Pays Chaumontais

The Nordex Group has been awarded a contract for the installation of the Pays Chaumontais wind farm in Jonchery, France.

Nordex will supply six of its N117/2400 turbines for the 14.4 MW project, which is being developed by Neoen. The contract includes turbines delivery, operation and maintenance for a period of 16 years.

ABB statcoms for East Anglia ONE wind farm

ABB has won a $30 million order from ScottishPower Renewables to supply two SVC Light Static Compensators (STATCOMs) that will help the utility integrate renewable energy into its grid.

The STATCOMs will increase power transfer capability, improve power quality and enhance grid stability following the construction of the East Anglia ONE offshore wind farm.

East Anglia ONE is a consented offshore project that will comprise over 100 wind turbines capable of generating 714 MW located off England's east coast.

STATCOM is part of ABB's family of FACTS (Flexible Alternating Current Transmission Systems) technologies that help reduce losses, enhance the capacity and flexibility of power transmission systems and contribute to more efficient and reliable grids.

Aquila expands Midtfjellet

Aquila Capital is increasing the installed capacity of its Midtfjellet wind farm in Norway by 40 MW to a total of 150 MW. Eleven Nordex N117 turbines are to be installed, each of which has a 3.6 MW-rated output.

Midtfjellet has been in operation since 2013 and currently consists of 44 Nordex N100 and N90 wind turbines that were built in two phases. The latest phase will be constructed in early 2019, Aquila said.

Siemens, Nexans selected for DolWin6

Siemens and Nexans have secured contracts to supply equipment for the 900 MW DolWin6 grid connection for offshore wind farms in the German North Sea.

The contracts were awarded by TenneT, which said that the cost of the whole project would be below €1 billion thanks to the competitive tender process and continued cost reductions for offshore technology.

Siemens will provide high voltage direct current (HVDC) equipment for the offshore substation, while Nexans will produce, supply and lay the cables.

Siemens said it will use its 'DC CS' direct current compact switchgear, which requires much less space than current air-insulated solutions and so will allow for a roughly 10 per cent reduction in the size of the offshore platform.

Dong Energy's Gode Wind 3 project has already secured a contract for connection to DolWin6, while a number of other offshore wind projects are competing for the link.

Vestas wins Dutch order

Eneco has placed an order with Vestas for a 22 MW wind farm near Rotterdam in the Netherlands.

The order is for the supply and commissioning of six V112-3.45 MW wind turbines in 3.6 MW power optimised mode. The machines will be installed at the Slufterdam wind park near Rotterdam, with delivery and commissioning slated for the second half of 2018.

The contract also includes a full-scope service agreement.

ABB upgrades Konti-Skan

ABB has won an order worth around $30 million from Svenska Kraftnät in Sweden and Energinet in Denmark to upgrade the control and protection system for the Konti-Skan high-voltage direct current (HVDC) transmission link.

The Konti-Skan transmission link was built 52 years ago as the first interconnection between Sweden and Denmark enabling electricity exchange. ABB will install its latest Ability MACH control and protection system to extend the life span of the HVDC link and further enhance power availability as well as grid reliability and efficiency.

International

Wärtsilä secures Iran deal

Wärtsilä is to supply engineering and equipment deliveries for two baseload power plants to Iranian energy companies Baran Niroo Beshel Co. and Tamin Niroo Saam Co.

Baran Niroo Beshel Co.'s plant will be located in the city of Savadkoh in the Mazandaran province, and it will consist of three Wärtsilä 34SG engines with a combined output of 29 MW. The other power plant, located in the city of Tabriz, will consist of two Wärtsilä 34SG engines with a total output of 19 MW.

Pöyry wins Dzora deal

Energy Invest Holding has awarded Pöyry with the engineering and consultancy services assignment for the headworks rehabilitation project for the Dzora hydropower station in Armenia.

Pöyry will prepare an inventory of the observed damage to the concrete structures and hydromechanical equipment, assess the reduced operability or the expected durability of the hydro scheme based on a risk analysis and clarify the geological/geotechnical potential causes for the damage in view of designing proper countermeasures.

The Dzora plant was built on the Dzoraget river and has been operating since 1932.

Siemens debuts new platform in Turkey

Siemens Gamesa has landed its maiden order from the Turkish investor Sancak Enerji for the supply of 118 MW at two wind farms in the region of Konya.

The order is Siemens Gamesa's first in Europe for its 3.3 MW platform. It will provide 20 of its G132-3.3 MW turbines (66 MW) at the Baglar wind farm and another 16 turbines (52 MW) of the same make at the Ardicli site.

Delivery of the turbines is scheduled to begin in the second quarter of 2018 with the facilities slated for commissioning in 2019. The company will also provide both facilities' operation and maintenance services for five years.

Wärtsilä signs deal for PV asset management

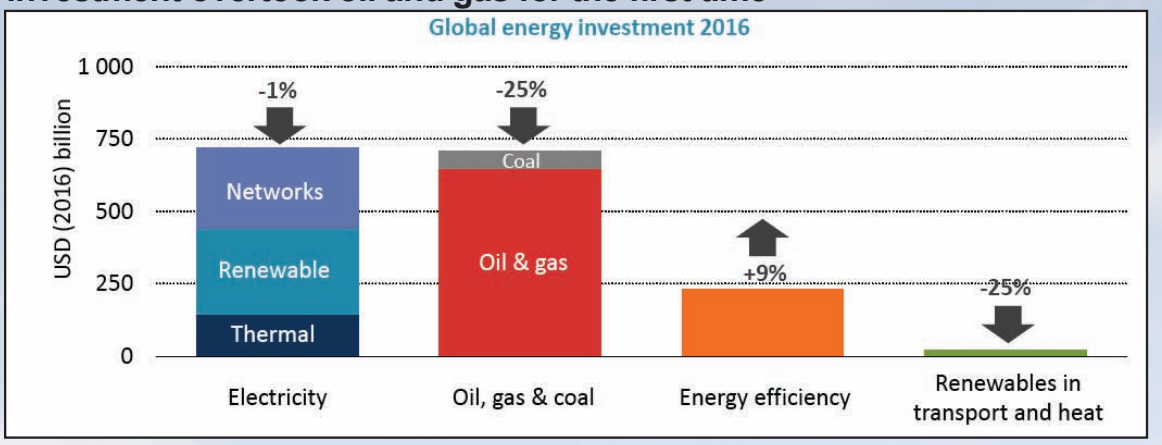
Wärtsilä has signed its first asset management deal for a solar photovoltaic (PV) plant.

The firm is to assume full responsibility for the operation and maintenance of the Essakane solar plant in the Sahel region of Burkina Faso, which shares a control system with a thermal power plant.

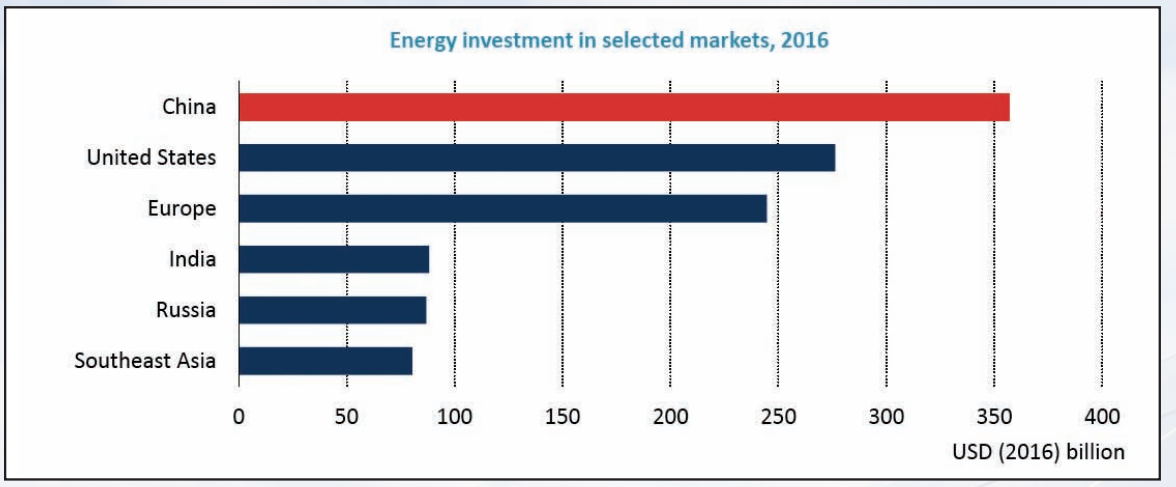
The seven year agreement includes the daily operation of the solar plant, preventive, scheduled and corrective maintenance, cleaning of the modules and coordination of operations with those of a thermal power plant using the same control system.

Wärtsilä will optimise the production of the PV plant and make sure that the thermal plant delivers effective, efficient and stable power

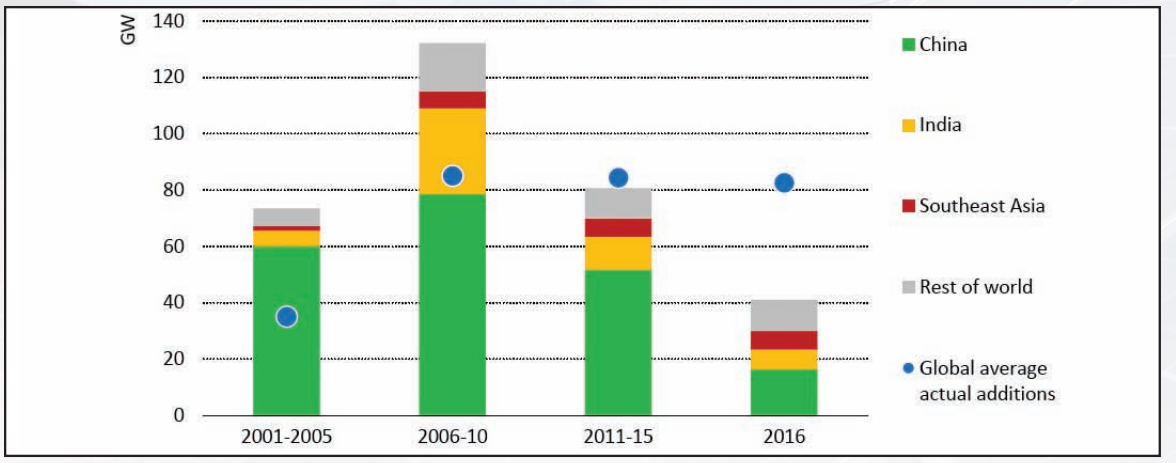
Global energy investment fell 12 per cent in 2016, a second consecutive year of decline. Total energy investment was $1.7 trillion in 2016. Electricity sector investment overtook oil and gas for the first time



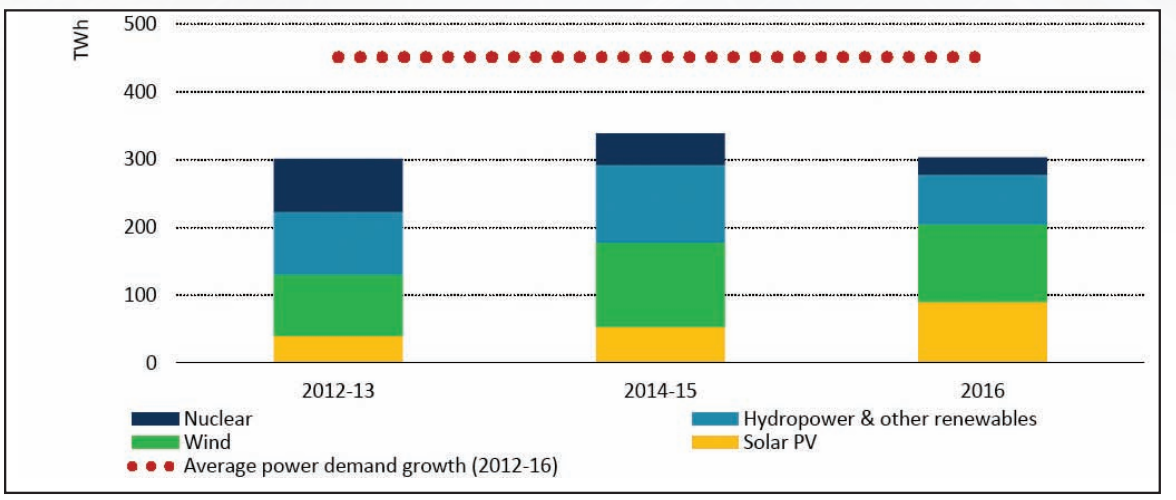
China remains the first destination of energy investment in 2016, representing 21 per cent of global energy investment



A wave of coal power investment is coming to a pause. In 2016, sanctioning of new coal power fell to the lowest level in nearly 15 years



Investment in clean power is not keeping pace with demand. Clean power FIDs in 2016 generate at only two-thirds the level of power demand growth



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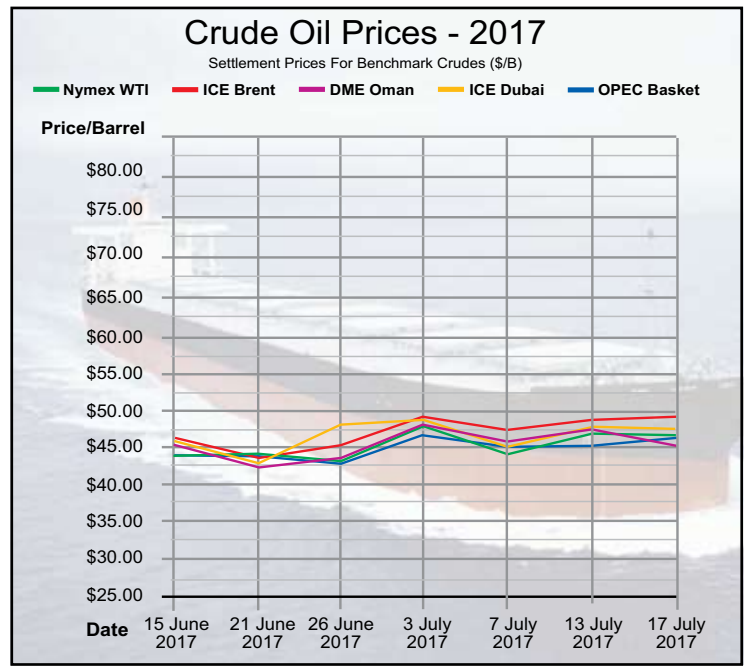
Source: World Energy Investment 2017. © IEA/OECD

Oil

Opec and friends face production dilemma



- Little change in oil price despite production cut
- Shale a real problem for Opec/non-Opec alliance

David Gregory

The results of the Opec/non-Opec crude producers' ministerial meeting in St. Petersburg were unknown as *The Energy Industry Times* went to press, but it is likely safe to bet that US shale oil production continues to forge ahead and that there has been little change in the price of oil since the latest round of deliberations.

What it will take to rebalance the oil market remains a mystery – or at least a scenario too painful for oil producers to contemplate.

The Opec/non-Opec alliance, formed late last year, has few options. It can stay the course and adhere more tightly to the production levels agreed, cut production further, or reopen the taps and produce at a rate that will cause a further price reduction that could work to drive shale producers out of the market again.

Bringing the market "back into balance", at somewhere near $60/b is the current goal of Opec, but the glut on the market appears impervious to the attempts made so far to increase prices. In an industry that is always boom or bust, this situation may change someday and crude will be in short supply. Plenty of analysts are pointing out that not enough investment is being made in future production to forestall any jump in demand once the longed-for balance comes and is surpassed.

Shale has proved to be a real problem for Opec and friends, especially since the decision to cut production at the start of this year led to an increase in oil prices that shale producers quickly took advantage of. Regardless of the course that Opec and partners take, shale oil – and gas – are an established part of the energy industry now, even if it does in the future serve the purpose of being the 'swing' element, as Saudi Arabian oil production once did.

The tight (shale) oil formations in the US make significant contributions to US oil production. The Energy Information Administration said the Permian and Eagle Ford areas in Texas will be producing around 2.9 million b/d and 1.3 million b/d, respectively by the end of 2018. The Bakken region in North Dakota in will produce at a rate of 1.1 million b/d.

Opec, meanwhile, is struggling to stick to its plans with non-Opec to keep 1.8 million off the market. According to the Paris-based International Energy Agency (IEA), global oil supply rose by 720 000 b/d in June to 97.46 million b/d. This was 1.2 million b/d more than in June 2016, with most of it coming from non-Opec producers, particularly the US. It said non-Opec production is expected to rise by 700 000 b/d in 2017 and 1.4 million b/d in 2018.

Global demand for 2017 is expected to average 98 million b/d and for 2018 it could average 99.4 million b/d, according to the IEA.

Opec production was up in June by 340 000 b/d to 32.6 million b/d, with compliance to the production cuts falling to 78 per cent, down from 95 per cent in May, and increased output by Opec leader Saudi Arabia, as well as Libya and Nigeria, neither of which were party to the original agreement to cut output.

Together, production from Libya and Nigeria rose by 700 000 b/d over the last few months, effectively erasing more than half of the 1.2 million b/d cut that Opec agreed with non-Opec producers. Energy ministers from both Libya and Nigeria were scheduled to attend the St. Petersburg meeting.

Prolonged low oil prices forced Opec member Ecuador to announce a few days before the meeting in Russia that it would no longer abide by its commitment to cut output by 26 000 b/d, prompting questions as to whether the agreement could really hold together until the end of March 2018, by which time Opec believes the market will be improving.

Many market analysts believe that it will take a further financially painful step to make the glut seep away. Producing more oil will bring prices crashing and cause a decline in revenues for oil producers that are already hurting from three years of low prices. Further cutbacks in production could bring losses in market share and more encouragement for shale producers.

Gas

Questions loom over completion of Southern Gas Corridor

Financial problems are said to be looming for the Southern Gas Corridor, according to a recent report.

Mark Goetz

Financial problems are said to be looming for the Southern Gas Corridor, the $45 billion BP-backed project designed to bring Azeri gas to Europe, according to a recent paper issued by the UK's Chatham House.

Azerbaijan has been unable to secure the $4 billion in financing that would cover its share of the 1840 km Trans Anatolian Natural Gas Pipeline (TANAP) across Turkey, and needs a further $2-3 billion for the Trans Adriatic Pipeline (TAP), according to the report. So far, Baku has landed only $1.4 billion in funding from the World Bank and Asian Infrastructure Investment Bank for TANAP, while approval of the balance is pending.

Loan applications to the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD) have been made to cover Azerbaijan's share of funding for TAP, but the report said this has been complicated by Baku's withdrawal from the Extractive Industries Transparency Initiative earlier this year. A transparency assessment of the country's oil and gas industry is now being carried out by a private UK accountancy firm in order to comply with those institutions' requirements.

The Southern Gas Corridor was a hot topic from the mid-2000s until earlier this decade when BP, the State Oil Company of the Azerbaijan Republic (Socar) and other partners in the Caspian offshore Shah Deniz gas field selected the pipeline routes to transport Azeri gas to Europe, enabling Europe to reduce its reliance on Russia for natural gas supplies. The combination of an expanded, existing Southern Caucasus Pipeline (SCP) that currently transports Shah Deniz gas to Georgia and Turkey, TANAP and TAP, would deliver 10 billion cubic metres/year (bcm/year) to Southern Europe and later be expanded to 20 bcm/year. But years of low oil prices and falling gas revenues have seriously hit Azerbaijan's financial growth and ability to invest the money it had planned when oil prices were in the $100/b range. The project is scheduled to be complete and operating by 2020.

Besides the investment in TANAP and TAP, Socar had also attempted in 2013 to purchase 66 per cent of the Greek national gas transmission system Desfa for €400 million. That deal collapsed at the end of last year after a ruling from the European Union declared that Socar could only hold 49 per cent of Desfa and after the Greek government passed a law reducing the rate at which tariffs for the transmission system could be increased. Socar agreed to sell 17 per cent of Desfa to Italy's Snam, but would not agree to pay the initial agreed price after the tariff rate was decreased.

Socar's purchase of the Greek grid, combined with its shares in TANAP and TAP, would have put it in a very advantageous position as a gas supplier to Southern Europe. The country has significant gas reserves that it intends to market in Europe in the future. The Shah Deniz reservoir is estimated to hold 1.2 trillion bcm of gas, and the country's entire reserves are put at 2.6 tcm. However, after completing Shah Deniz Stage 2 (SD2), it will be the mid-2020s before further gas development becomes a viable proposition.

According to the Chatham House report, Azerbaijan owes some $9 billion in loans that is due to be repaid in 2020 and it appears unlikely that hydrocarbon revenues will be sufficient to meet that deadline. It said that revenues from Shah Deniz sales have fallen from $532 million in 2014 to $64 million in 2016.

The pipeline project is also facing competition from Russia's TurkStream gas pipeline project, which was devised after the South Stream project was abandoned by Moscow in the face of EU regulations. Russia's Gazprom plans to ship 15 bcm/year to Southern Europe via a subsea Black Sea pipeline that will land in Turkey and stretch to the Greek border. Furthermore, Moscow has expressed an interest in buying excess capacity in an expanded TAP pipeline if Azerbaijan is unable to fill phase two capacity. Shipping Russia gas through TAP would be the opposite of the pipeline's original purpose.

But according to regional leaders, the Southern Gas Corridor is on course. Speaking in Istanbul in early July at the World Petroleum Congress, Azeri President Ilham Aliyev said the project would be successfully completed and would supply gas to countries in the region for years to come. Aliyev said work on the SCP is 87 per cent complete, TANAP 77 per cent complete and the TAP 44 per cent complete.

Turkey's President Recep Tayyip Erdogan, also speaking at the Congress, said TANAP, which is a strategic energy project for Turkey, will be completed and operating by mid-2018.

Incentivising energy storage

Recognising the potential of storage, the US Federal Energy Regulatory Commission and a number of states throughout the country have recently taken steps to promote the technology. The success or failure of these programmes may inform the decisions of other regulators as they formulate their own policies.

Jay T. Ryan, Michael Didriksen, and **Kyle H. Henne**

The ongoing technological development and expanding implementation of electric storage is poised to drastically change the face of modern energy markets. Among other things, electric storage devices help manage peak demand, increase the viability of widespread intermittent renewable energy, and provide valuable grid support through frequency regulation.

Recognising this potential, the Federal Energy Regulatory Commission (FERC) and a number of states throughout the US have recently taken steps to promote storage technology through procurement mandates, financial incentives, and inclusive market rules.

In November of 2016 FERC issued a proposed rulemaking that, if adopted, will significantly expand the ability of energy storage resources to participate in wholesale electricity markets. The proposal, described as a "continuation of [FERC's] efforts to promote competition in organised wholesale electric markets by removing barriers to the participation of new technologies," would require regional transmission organisations and independent system operators (RTOs/ISOs) to update their market rules. The update would allow energy storage resources to sell all of the electric services they are technically capable of providing, including capacity, energy, and ancillary services.

FERC hopes to address the fact that, in many cases, existing resource participation models do not recognise the unique physical and operational characteristics storage can provide. Even where storage-specific participation models have been developed, some organised wholesale markets have imposed requirements that hinder broad participation (e.g., minimum operating times, prohibiting injecting power onto the grid, restricting participation to the regulation market only, etc.).

The proposed energy storage rule would significantly increase the potential for a growing class of energy storage providers, ranging from flywheels and batteries to pumped-storage hydroelectric facilities, to more fully participate in, and receive payment from, organised energy markets. The rule would also likely result in greater uniformity across US wholesale energy markets with respect to energy storage, promoting additional investment.

Didriksen: FERC's policy of promoting an equal footing for storage providers in wholesale markets could be borrowed in other markets

In another proposed rulemaking, FERC has suggested amendments to its pro forma Large Generator Interconnection Agreement that would require regulated transmission providers to clarify its applicability to storage resources. Although some transmission providers have already met this requirement, FERC has argued that broader adoption would "ensure that all transmission providers have interconnection procedures and agreements applicable to… electric storage resources," resulting in just, reasonable, and non-discriminatory rates.

In January of 2017 FERC issued a policy statement designed to promote participation by storage resources in wholesale markets. In the policy statement, FERC provided guidance and clarified its precedent related to cost recovery for electric storage resources. The policy statement specifically establishes the ability of electric storage resources to concurrently provide separate services at, and seek to recover costs through, both cost-based and market-based rates. This provides storage resources with more flexibility with respect to how they participate in wholesale markets and, potentially, allows for greater financial returns for savvy project developers.

Specifically, FERC's policy statement addressed three main concerns raised in prior proceedings.

First, FERC determined that double recovery of costs by storage resources can be avoided by crediting market-based revenues back to cost-based ratepayers. This can be accomplished by either recovering the full cost of the storage facility through the cost-based rate, but crediting all market-based revenues to cost-based customers, or by offsetting the revenue requirement used to develop the cost-based rate by the anticipated market-based revenues.

Second, FERC explained that it did not share commenters' concerns regarding adverse market impacts. Instead, it analogised allowing multiple revenue streams for storage resources to the multiple revenue streams already available to generation resources and vertically integrated utilities.

Finally, regarding independence of market participants from RTOs/ISOs, FERC stated that some amount of coordination between storage resource owners or operators and RTOs/ISOs will be necessary. FERC explained that when cost-based services must be provided, RTO/ISO dispatch should receive priority, with penalties for any failure to perform. Market-based services, however, may be implemented according to parameters provided by resource owners or operators, just as is the case for other market participants.

Although FERC's recent efforts have been substantial, it should not be forgotten that the proposed rules and policy statement discussed were issued by a Democratic-majority FERC, the majority of whom have now left the agency. Moreover, Commissioner LaFleur, who will remain on the Commission, dissented from the policy statement, voicing concerns about its lack of clear guidance for evaluating particular filings and its potentially broader implications with respect to generic multiple-payment stream issues, including state policy initiatives. It remains to be seen how a Republican-led FERC will address electric storage.

Ryan: The proposed energy storage rule would significantly increase the potential for a growing class of storage providers

Outside of FERC, states have also undertaken initiatives in the form of both mandates and incentives to encourage market entry of energy storage resources. California and Oregon have imposed specific requirements on investor owned utilities to procure a certain minimum level of capacity in energy storage facilities. In the past year both Massachusetts and Nevada have passed laws directing state regulators to consider adopting similar energy storage requirements. Pursuant to the Massachusetts law, the Massachusetts Department of Energy Resources determined that it would be prudent for the state to adopt such a requirement, and on June 30, 2017, announced the adoption of an "aspirational" 200 MWh energy storage target to be achieved by January 1, 2020.

Other state policies provide financial incentives to utilities and customers to implement advanced energy storage technology. States such as California and North Carolina have promoted research and development in energy storage technology through the creation of pilot or demonstration projects. To reduce the impact of the anticipated closure of the Indian Point nuclear facility in New York, Consolidated Edison and the New York State Energy Research and Development Authority partnered to provide a schedule of incentive payments to customers and developers based upon implementation of different storage technologies, with bonus payments for larger scale projects.

Likewise, California's Self Generation Incentive Program allows customers to receive payments for implementing a number of advance technologies, including the installation of energy storage capabilities on a customer's facilities. Funding for the program was recently increased in a manner that heavily favours payments for energy storage projects.

Other states are testing tax incentives as a mechanism to promote the deployment of energy storage technologies. For example, the Maryland General Assembly, with broad bipartisan support, passed S.B. 758, which Governor Hogan signed into law on May 4, 2017. The legislation provides income tax credits for taxpayers who install certain energy storage systems, making Maryland the first state to offer such a dedicated energy storage tax credit.

The law provides credits for energy storage systems that are "used to store electrical energy, or mechanical, chemical, or thermal energy that was once electrical energy." Thus, it covers more than just battery storage systems. The tax credits are equal to 30 per cent of the installed cost of the energy storage system, with a $5000 cap on systems installed on residential property and a $75,000 cap on systems installed on commercial property.

Credits are non-refundable, and unused credits are not carried over to other tax years. The credits are only available for energy storage systems installed between January 1, 2018 and December 31, 2022. To receive credits, taxpayers are required to apply to the Maryland Energy Administration for tax credit certificates, and the total incentives are subject to a combined $750 000 cap per year. Applications for tax credit certificates are reviewed on a first-come, first-served basis.

Given the variety of policies that have been implemented or proposed, other energy regulators, including those in US states without storage-promoting policies and those in international markets, may find it beneficial to look to the experience to date in the US. FERC's policy of promoting equal-footing participation for storage providers in wholesale markets through, to an extent, uniform rules, could easily be borrowed in other markets.

Jurisdictions that are more directly involved in determining which new resources will ultimately be developed could borrow from the policies in Oregon and California that direct minimum levels of storage procurement. A less heavy-handed approach could use tax incentives or incentive payments to broadly promote storage or, as in New York, to target specific resource planning concerns. Examining the successes and failures of these programmes as they mature may inform the decisions of other regulators as they formulate their own policies.

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Renewables change the landscape for gas

Although the current market outlook for gas fired generation is at a low in Europe, generators can help themselves by valuing their flexibility and adjusting their trade strategies in a market increasingly dominated by renewables.

Rob Lalor

The European power markets have gone through periods of considerable change over the last 100 years, with levels of electricity demand having risen from nominal levels in the early 1900s to peak levels within the last two decades.

However, few changes have arguably had greater impact than the recent rise of renewables and the associated recent pushes towards greater levels of electrical efficiency and sustainability – which has had a huge impact on the way in which coal and gas plants operate in an ever changing market.

Although the current market outlook for gas fired generation is at a low in Europe, generators can help themselves by valuing their flexibility and adjusting their trade strategies to the new market situation. This still leaves an uncertain future for gas across European markets that continue to be dominated by coal, but Britain may yet prove to be the template for an EU-wide transition towards this cleaner fuel.

In the immediate future, this means that power stations need to be able to maximise their gas-burning efficiencies at lower levels of generation and would ideally be able to generate at low levels of power output without going offline. This can only be achieved using flexible equipment that is well suited to a highly variable generation requirement.

In the longer term, and as renewables continue their upward growth, levels of run hours will decline at gas fired power stations with below average efficiency levels. For the lowest efficiency combined cycle gas turbine (CCGT) power stations this will mean that plants will become uneconomic to run. At this point, plants will need to start converting to open cycle operation, as has been seen in Britain with plants such as Brigg, Barry, Corby and Peterborough.

Lalor: France's intention to bring in a carbon price floor in line with the UK could mark the first step of a correction in carbon costs across Europe

Converting a CCGT to run as an open cycle gas turbine (OCGT) has numerous benefits including reduced maintenance costs, faster response rates and the ability to carry out shorter runs, but it does reduce the efficiency of a power station down to around 30 per cent (from 40-50 per cent).

These lower efficiency levels sound counter-productive, but running hours diminish the impact of lower efficiency declines, whilst at the same time the levels of income from availability fees rather than utilisation fees rises; increasing the need to control maintenance and other fixed costs.

The ultimate goal of a clean electricity system is to be backed almost exclusively by renewables and storage, but along the way this transition is going to be facilitated by gas fired power stations that will have to adapt to their continually changing circumstances. As this transition progresses, all the old accepted practices of the market will go out the window and new best practices will have to evolve on the fly and along the way.

This situation has been created by the unparalleled levels of change seen in the market over the last decade. In Britain, for example, levels of fossil fuel generation fell to 56 per cent between 2010 and 2016, with renewables in 2016 providing around 21 per cent of total generation. This recent trend has resulted in more than a mere loss of total generation; it has meant that thermal generation has had to fit not only around changing demand but also around the changing levels of renewable generation in the market.

Increasingly, lower efficiency plants have had to wait for periods of low renewable generation and rely on earning higher scarcity payments, both through higher peak prices and capacity mechanism fees.

As levels of renewable capacity have continued to grow, higher efficiency plants have increasingly had to turn off overnight during periods of high wind and mid-merit plants have increasingly had to become more flexible to respond to changes in market values. Lower efficiency plants have had to change their business model entirely to reduce their underlying costs.

In many cases, these latter plants have moved to open cycle operation, which reduces their efficiency to around 30-35 per cent but also allows for shorter run times, lower operating costs and faster response times.

At the same time, the plants entering the market have predominantly been small flexible gas engines that can respond within minutes, deliver short runs and then go offline and actively target the highest value periods of a given day.

Currently the transition from one market to another is creating high levels of value for these plants, which generate when prices peak. Looking far out into the future, there is likely to be a shift towards much lower operation hours in the form of standby plants, with the wider market completing its transition towards renewables backed by low-cost storage technologies.

Britain has at times seen a complete shift away from coal plants. Whilst average generation at coal plants in 1991 amounted to the equivalent of full output through the year at 24 GW of coal stations (generating at 100 per cent of their potential), the market is set to see coal fired capacity drop to only 6.6 GW from 2020/21 – having already seen considerable levels of plant retirements at coal power stations.

This has come as the UK sees a UK-only levy on carbon worth around £18/t CO_2 that has pushed coal station costs above those of gas fired plants and propelled them out of the market.

Whilst Europe has followed a similar route in terms of renewable expansion – with many countries seeing high levels of wind and solar installed capacity – gas-fired plants on the continent only have to pay the much lower EU ETS carbon price which has allowed coal plants to remain competitive and provide a large share of power generation in many European countries.

By contrast, Britain – a country with a long history of burning coal and plentiful coal supply – saw its first 'no coal day' on April 21, 2017. France and Belgium have little dependency on coal and gas due to their huge nuclear production and the fact that they have some hydro and pumped storage to balance out renewables, but Germany and the Netherlands have a much larger dependency on coal and gas.

As no carbon levy exists in Europe, it is not so much renewables that are pushing gas out of the market. Coal still comes before gas in the European mainland merit order and this has caused some very hard times for gas fired power stations. In recent years, the Netherlands has seen some of the most modern gas fired plants shut down (Rijnmond II and Maasstroom), whereas the second turbine of the Enecogen power station was sold and shipped off to Israel before even going into operation.

Another factor in the difficult period for gas generation is the limited rewards for flexibility in the European balancing markets. Although balancing mechanisms allow for more assertive pricing of flexibility, this has not yet been discovered as a 'trading' product on a large scale, with a large volume of the available capacity not being traded. This has reduced the ability of many power stations to secure the necessary levels of income to continue operations.

Providing balancing power, however, is not just about burning more or less fuel to adjust output; generators also need to be around to provide this flexibility. This 'being around' reward is related to market conditions and psychological factors. As the case for baseload operations for traditional generators declines – losing ground to renewables – fossil generators wanting to remain in the market will need to capitalise on their added value, which is their ability to provide flexibility – something GB-based plants have been able to do effectively.

In post-election France and the Netherlands, support for a carbon tax or a carbon floor price is an important aspect of the political agenda and the US leaving the Paris agreement has only made this a more prominent agenda item. Any form of carbon price increase will favour gas over coal and reinforce gas's position.

France has announced that it intends to bring in a carbon price floor in line with that used in Britain at €30/tonne (versus around €25/tonne for Britain) and this could mark the first step of a correction in carbon costs across Europe that is able to take the activity seen in Britain and replicate it on an EU-wide scale. Such a move will face political opposition, but this early move by France is an extension of the template already set out by Britain, a template that seems ready to be applied in other parts of Europe.

However, it's not just politicians who may influence market conditions for gas. Public opinion around the major population centres is increasingly involved in the battle against pollution.

A good example is the activity surrounding the Dutch Hemweg 8 power station in Amsterdam – the oldest coal plant still in operation and said to be the most polluting.

After an initiative by green energy supplier Vandebron, which made a first bid to buy the plant and shut it down, a coalition has formed consisting of Vandebron, local government, Greenpeace and others, raising over €5 million. A crowdfunding initiative saw 42 000 people pledge to raise cash just to close down the plant. Since coal plant is still better positioned than gas fired stations, the initiative has been unsuccessful in buying the plant, but it has started to shape discussions around coal and carbon pricing.

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Frequency response goes offshore

The 90 MW Burbo Bank wind farm and its 2 MW/2MWh battery will help to manage grid stability

A wind-battery storage hybrid system being installed at the Burbo Bank offshore wind farm is expected to pave the way for rapid frequency response services to ensure grid stability. This kind of development comes in the face of a dramatic fall in system inertia as thermal energy is phased out and replaced by variable renewables.

David Appleyard

Danish power player DONG Energy has revealed plans to equip its Burbo Bank offshore windfarm with energy storage capabilities to offer frequency response services for grid stability.

In a claimed world first, the 90 MW wind farm and its 2 MW/2MWh battery will form a hybrid system to help manage grid stability for National Grid, the company which owns and operates the UK's national electricity transmission network. The ability to inject bursts of active power allows the grid to respond to changes in order to maintain frequency at or close to 50 Hz.

Frequency response services are typically needed in the event of a disturbance on the grid, for example, a unit outage. Previously, these types of services were supplied using conventional thermal generation technology like gas turbines. However, according to James Sun, Senior Lead in DONG Energy's Asset Business Development team, combining a battery system with a windfarm can provide faster and less costly frequency support than had typically been the case.

Sun explained: "Digital technology can respond quickly, in a matter of seconds or less, whereas in conventional plants that have these massive rotating pieces of metal generating power it takes time for them to change what they are doing."

He continued: "The fastest current frequency response service has the requirement to respond in 10 seconds and that's because thermal plants require that length of time to actually respond. But 10 seconds is a long time for the frequency to continue to drift away from the set point without correction.

"If you start to introduce batteries, wind farms and other digital technology that can respond in a matter of a second or less, you can address that frequency drift much sooner and therefore minimise the amount of overall service that you might need."

Minimising the frequency response services required is expected to significantly reduce costs, ultimately resulting in lower prices for consumers.

Wind farms are in fact already capable of delivering frequency response services, but usually only by down regulating, through feathering the blades for example. The 90 MW Burbo Bank can down turn by 25 MW for instance. Adding a battery to wind farms effectively enhances this capability by also being able to discharge and therefore inject power into the grid.

Sun said: "These services are usually of very short duration, so we are talking about very small amounts of energy and that is what we are looking at given the state of battery technology today."

The 2 MW battery system will be supplied by ABB, which also previously worked on the power export elements of the Burbo Bank wind farm extension, supplying the grid connection equipment under a £30 million deal announced in 2014.

Recognising that the rapidly changing nature of the energy landscape is increasing frequency volatility, both regulators and industry are looking to improve the response times for frequency control inputs.

In particular the increasing volumes of variable output renewable generation on the system together with a steady reduction in the proportion of stable thermal capacity such as coal and nuclear are dramatically curbing system inertia, giving rise to an increase in the volume and speed of frequency response requirements. Under existing arrangements this increased response requirement is anticipated to see the cost of controlling frequency increase by £200-£250 million per annum by 2020.

Dr Richard Smith, Head of Network Capability (Electricity) at National Grid, explains: "With decarbonisation and decentralisation the energy mix is changing. As you get that shift away from those types of power station, you have less spinning metal to keep that inertia of the system going 50 Hz so you need more corrective action." He continued: "We're looking at alternative ways of getting that response in a world where we have less inertia."

Indeed, in late August last year National Grid revealed that sub-second frequency response contracts had been awarded to eight providers using battery storage for balancing services under its so-called Enhanced Frequency Response tender. Enhanced frequency response is defined by National Grid Electricity Transmission as being a service that achieves 100 per cent active power output at 1 second (or less) of registering a frequency deviation.

Smith said: "We run tenders for frequency services on a regular basis as part of a stable operation. The recent tender that we did and also an innovation project we have running is more about increasing the speed."

National Grid procured 200 MW of enhanced frequency response through this tender. According to the company, this enhanced ability to control variations in frequency almost immediately will result in reduced costs of approximately £200 million ($300 million). Bids were received from 37 providers, and of the 64 unique sites taking part, 61 are for battery assets. Contracts have been awarded on a four-year term.

Commenting on the tender, Cordi O'Hara, Director of UK System Operator, National Grid, said: "I believe storage has much to contribute to the flexible energy system of tomorrow. This is the beginning of an exciting new chapter for the industry."

The tender follows on from a UK energy regulator Ofgem-backed Enhanced Frequency Control Capability (EFCC) research project, which is due to conclude in March 2018.

Launched in November 2014, Ofgem awarded £6.9 million ($10 million) to test the capability of low-carbon technologies like wind and solar to provide rapid frequency response as part of an overall £46 million Electricity Network Innovation Competition (NIC) programme. The project will be run in partnership with DONG Energy, Siemens, GE Grid Solutions, Centrica, Flexitricity, BElectric and the Universities of Manchester and Strathclyde.

According to Ofgem, the objective of this project is to develop and demonstrate an innovative new monitoring and control system which will obtain accurate frequency data at a regional level, calculate the required rate and volume of very fast response and then enable the initiation of this required response.

Smith explained: "You're operating at that millisecond response time level, which is an automated process so getting all of those things proven to work in an operational real-time environment is very important."

Having demonstrated the viability of obtaining rapid response from new technologies such as solar PV, storage and wind farms the research will support the development of an appropriate commercial framework that will provide incentives and ensure these new technologies can effectively compete with existing technologies in the ancillary service market.

Smith commented: "Buying these commercial services and new technology, the pricing arrangements will be different. It's not necessarily safe to say it will be cheaper. As the energy mix continues to change what we do still see is the level of inertia falling; so the job gets more difficult. Actually, we work harder to even stand still."

And as Smith observed: "Traditionally, we have mainly looked to gas and coal fired power stations to provide frequency response. In future, it's vital that we look at the potential for lower carbon and non-generation solutions to help maintain frequency within the required levels, for example wind and solar or demand response, storage and interconnection".

He added: "I'm looking forward to seeing how the DONG Energy solution of storage connected to the offshore wind farm will provide services to help us respond to day-to-day operational challenges."

This is a point picked up by Sun. "We do expect to make a return on the investment, but it also at the same time is a platform to demonstrate. This is the first time that an actual wind farm is being used in conjunction with a battery as a hybrid unit for providing the service."

Certainly as more conventional thermal generation is phased out to be replaced by renewables, this type of system is expected to become even more prevalent as National Grid and other transmission system operators ensure that the renewable assets that are part of the energy system of the future can also deliver the services that used to be provided by thermal plants.

Indeed, in many respects the advent of renewables and storage systems may prove to be a far more effective solution to maintaining grid frequency than the incumbent thermal capacity. Wind farms and other renewable generators are typically decoupled from the grid, using power electronics to ensure synchronisation, for example where power is fed onshore via HVDC cables.

Potentially, this is a new form of functionality highlighted by Smith. "A battery alongside a wind farm is not synchronised, but can simulate synchronisation and can link to the network in a way to provide services that give us the equivalent of providing a free-from-inertia synchronised linked power station," he said.

With 90 MW of wind coupled to 2 MWh of battery storage, the Burbo Bank wind farm represents an opportunity to capture more of the landscape of capabilities that National Grid needs to maintain grid stability. In this context, the whole is far greater than the sum of the parts.

The containerised 2 MW/2MWh battery system

Reasons to be cheerful?

Junior Isles

Ian Dury and the Blockheads was not really my cup of tea. Yet while the lyrics to their 1979 hit seemed random, to say the least, for some reason the hook is unforgettable. Again, the chorus line came to mind when reading the International Energy Agency's (IEA) World Energy Investment (WEI) 2017 report.

While some might initially view the report's headline of a fall in world energy investment with concern, it does in fact give reasons to be cheerful. Closer inspection should lead to the conclusion that the findings confirm the energy industry is continuing to move in the right direction in terms of becoming cleaner and more efficient.

The WEI 2017 report revealed that global energy investment fell for the second year in a row, decreasing by 12 per cent in 2016. The Paris-based agency's figures showed that global energy investment was $1.7 trillion in 2016, down from the $1.8 trillion figure reported for 2015.

According to the IEA, energy investment has been falling because of two main reasons: firstly the reaction of the oil and gas industry to a prolonged period of low oil prices; and second, technological progress that is reducing investment costs in both renewable electricity and the oil and gas industry.

After a 44 per cent plunge between 2014 and 2016, the report says upstream oil and gas investment has rebounded modestly in 2017. A 53 per cent upswing in US shale investment and resilient spending in large producing regions like the Middle East and Russia has driven nominal upstream investment to bounce back by 6 per cent in 2017 (a 3 per cent increase in real terms). Notably, it says the oil and gas sector is getting better at cutting costs.

"The oil and gas industry is undertaking a major transformation in the way it operates, with an increased focus on activities delivering paybacks in a shorter period of time and the sanctioning of simplified and streamlined projects. The global cost curve has rebased, and a significant component of the cost reduction experienced over the last two years is likely to persist in the foreseeable future," it stated.

Launching the report, Laszlo Varro, Chief Economist at the IEA pointed out that last year was a landmark year for the energy industry. He said that with the big cuts in the oil and gas sector, it was the first time that investment in that segment was surpassed by electricity.

Global electricity investment inched down by just under 1 per cent to $718 billion, with an increase in spending on networks partially offsetting a drop in power generation. Investment in new renewables-based power capacity, at $297 billion, remained the largest area of electricity spending, despite falling by 3 per cent.

A key takeaway from the report is that although renewables investment was 3 per cent lower than five years ago, capacity additions were 50 per cent higher and expected output from this capacity about 35 per cent higher. This is due to declines in unit costs and technology improvements in solar PV and wind. At the same time, investment in coal fired plants fell sharply, with nearly 20 GW less commissioned.

It was interesting to note that while project finance still only represents a small portion of global energy financing – just 7 per cent of the total – it plays an important and growing role in financing renewable and clean energy projects. It is especially important in utility-scale projects in countries where long term contracts are available, as well as gas infrastructure pipeline linked to natural gas facilities.

Energy is a capital-intensive business and in most countries, the key to attracting investment is having the right energy policy.

China remained by far the most important investment destination. Although investment in oil and gas, as well as coal has declined, the country leads the way in spending on clean energy and energy efficiency. "What is increasing in China significantly, is investment in low carbon power generation and electricity networks," said Varro. He also noted that energy-efficiency investment rose 9 per cent, a rate at which if sustained would see it overtake Europe as the biggest spender on energy efficiency this year. "Energy efficiency investment is, overall, doing well but it is a fragile success that is dependent on policy considerations… Efficiency is doing well where these policies are in place," he said.

Similarly, investment in India has increased, where electricity reforms and robust policy to promote renewables, has resulted in significant growth.

In the US, however, the IEA says energy efficiency investment is stagnating due to the impact of low oil prices. But even here, where the Trump administration is attempting to undo the former President's clean energy work, there are still reasons to be cheerful.

Despite a drop-off in oil and gas spending last year, the US increased its global share in energy investment primarily due to an increase in electricity and in particular renewables for power generation. As Varro noted: "Renewable energy investment in the US is doing very well."

And despite Trump's best efforts, Varro does not see coal coming back any time soon. "The last time anyone made an investment in a coal fired plant in the US was in 2011. The collapse in investor interest in new US coal plants took place under the Bush administration when electricity demand started to slow down and shale gas started to emerge. Weak electricity demand growth and the abundant availability of cheap domestic gas are the two most important factors by far. None of this has changed, so we don't see any investor appetite for new coal plant in the US."

Indeed the IEA says the days of coal, which has been the major fuel for power generation this century, are numbered. "Coal was the single biggest source for the growth of power generation, especially in China and India. This coal investment is coming to an end; at the very least it is coming to a pause."

According to the IEA, the coal fired capacity that is starting construction fell from over 130 GW ten years ago to only 40 GW last year. The decline is particularly visible in China, where the country's electricity sector is plagued with over-capacity and power demand growth has slowed compared to previous years.

It is a similar story for coal in India. The IEA attributes the fall in coal fired generation to two factors: firstly the financial difficulties India's electricity sector and secondly the increased competitiveness of solar power.

While coal fired generation investment remains robust in many developing countries in Southeast Asia such as Indonesia, Thailand, Vietnam and Pakistan, there is no doubt that the ongoing shift in the energy mix is having a positive effect on carbon emissions. The IEA report also found that carbon emissions stagnated in 2016 for the third consecutive year – another reason to be cheerful.

Commenting on the changing generation landscape, Varro said: "The biggest area of power generation investment is renewable, low carbon generation. Wind and solar power have been doing very, very well and 2016 was a record year. We can expect 200 TWh of electricity from the wind and solar investment [made] in 2016, which is almost 1 per cent of total global electricity consumption."

While these are all reasons to be cheerful, we should not get carried away. Varro said: "In the last five years, the truly remarkable success of wind and solar was only sufficient to compensate for the investment shortfalls in hydro and nuclear, without a structural breakthrough in the speed of increase in low carbon electricity. In fact, this speed of increase in low carbon electricity is below the average growth of global electricity consumption. So with this level of low carbon investment, fossil fuel based power generation will have to continue to increase as it has for the past five years."

There is therefore still work to be done on the journey to a low carbon energy future. The full title of Ian Dury's song was 'Reasons to be cheerful: part 3'. Why 'part 3' is anyone's guess. I also cannot say what part of the journey the energy industry is on, but there are reasons to be cheerful.

Cartoon: jemsoar.com