THE ENERGY INDUSTRY TIMES

May 2017 • Volume 10 • No 3 • Published monthly • ISSN 1757-7365 www.teitimes.com

What's in store post-Brexit?

Collaboration will be key to unlocking the UK's full potential for energy storage when it leaves the EU. ***Page 13***

Smart moves may not be easy

Future smart grid and smart meter opportunities exist but may be difficult to realise, says the GSGF. ***Page 14***

Final Word

After Trump's first 100 days in office, Junior Isles says set not thine promises in stone. ***Page 16***

News In Brief

Renewable installations hit record levels
Renewable installations hit record levels in 2016 as costs continue to fall, according to a recent report.
Page 2

Mexico converts waste
Up to five waste-to-energy plants are to be built in Mexico as the country seeks to improve the green credentials of its energy sector.
Page 4

US viewpoint
Future carbon emissions may not be so gloomy, despite Trump's new energy policies.
Page 5

Vietnam approves solar tariffs
Vietnam's solar sector has received a boost with the Prime Minister's official approval of the support regime for the development of solar power projects.
Page 6

EDF pours Hinkley concrete
Nuclear power projects are starting to make progress in the UK but Westinghouse's bankruptcy has highlighted the risks of undertaking such mammoth projects..
Page 7

LM deal brings blades in-house for GE
GE has closed a deal to buy LM Wind Power, a move it hopes will give it the edge in an increasingly competitive market.
Page 9

Fuel Watch: Opec weighs question of continued production cut
Opec and its non-Opec partners, in a plan to reduce global crude supply, may opt to extend a cutback in crude oil production beyond June.
Page 12

Technology: Getting the drop on coal
A new type of black pellet looks set to offer generators a true 'drop-in' biomass replacement for coal.
Page 15

Climate change concerns grow post-Brexit

UK Prime Minister Theresa May triggered Article 50 at the end of March

There is growing concern that climate change and green energy targets will suffer following the UK's triggering of Article 50. **Junior Isles**

EU and UK ministers are being urged to keep discussions on climate change and environmental policy at the heart of discussions following the triggering of Article 50.

The triggering of Article 50 at the end of March, formally beginning the UK's process of leaving the European Union, has raised concern in the energy sector on both sides of the Channel.

Eurelectric, the Brussels-based organisation representing Europe's electric utilities, recently outlined its views on the future energy relationship between the EU and the UK.

"We welcome the certainty that triggering Article 50 provides and advocate for negotiators to demonstrate urgency in establishing the negotiating framework, while engaging with affected interest parties," said Eurelectric's Secretary General Kristian Ruby.

"Following the triggering of Art. 50, we call upon the negotiators to recognise the importance of energy in the upcoming debate and to keep negotiations on the Internal Energy Market separately from those on the EU single market."

The discussion surrounding climate change goals and environmental rules was one of several key elements it said must be included in the agenda. Eurelectric urged the UK and EU to continue to work together internationally on climate issues, including UK participation in emissions trading with the EU.

It said a fundamental component for the fair trading of electricity is the carbon price paid by electricity generation in one country relative to another. To avoid disruptions, the organisation said the UK should continue to participate in the current trading phase. Otherwise a linked emissions trading scheme (ETS) would be highly desirable in the longer term.

Notably, Eurelectric says careful consideration needs to be given to the impacts on the EU's 2030 energy and climate framework. It believes the UK's departure could well require an adjustment of the non-ETS, renewables and energy efficiency targets applicable to other Member States, or impact other political commitments in the 2030 framework such as the modernisation fund.

Brexit is also fuelling intense debate in the UK. Reacting to the Prime Minister's triggering of Article 50, Nick Molho, Executive Director of the Aldersgate Group in London, noted that several key environmental and climate change policies are derived from EU legislation and that Brexit will "open up opportunities to make improvements in certain areas".

Continued on Page 2

UK commitment to sustainable energy unpredictable, says WEC

A recent report by the World Energy Council (WEC) says that despite investment in renewables being ranked as a top priority by energy leaders globally in 2017, Brexit has left the UK's commitment to future sustainable energy projects uncertain.

According to its World Energy Issues Monitor 2017: 'Exposing the New Energy Realities', the WEC says that the UK's decision to leave the European Union has created ambiguity surrounding its future participation in schemes such as the Energy Union project.

It also says there is further uncertainty around continued funding from the European Investment Bank and around regulations such as EU state aid rules, the 15 per cent interconnection target by 2030, the Renewable Energy Directive as well as the EU Industrial Emissions Directive 2010.

Francois Austin, Board member, UK Member Committee of the World Energy Council and Partner & Global Head at Oliver Wyman, commented: "Political and regularity uncertainty including Brexit is making market design unpredictable and are barriers to sustained investments needed to transform and update energy infrastructure in the UK, which has been estimated as being £215 billion by 2030."

Other findings related to the UK include:

- New physical and virtual risks – Cyber-attacks are posing ever greater threats to the energy sector. If a critical attack was to occur on the electricity distribution network of London and the South and East of England between 9 million and 13 million electricity consumers could be affected with economic losses ranging from £11.6 billion to £85.5 billion
- Commodity price volatility remains the number one critical uncertainty. Compared to 2015 the issue of commodity prices in 2016 and 2017 is seen as less uncertain but higher in impact, by UK energy leaders.

Now in its eighth year, the World Energy Issues Monitor provides a snapshot of the current priorities, facing global energy leaders.

This year's survey highlights shifting priorities in the energy sector with an increasing impetus towards a lower carbon future. Disruptive technologies including renewable energies and energy efficiency are impacting top action priorities for energy leaders globally in 2017.

The survey of more than 1300 energy leaders in 95 countries showed that renewables ranked high in impact within every region. It noted that solar has seen immense growth in installed capacity reaching 227 GW by the end of 2015, while global wind power generation capacity increased at a rate of 17.2 per cent in 2015.

Commenting on the report, Dr Christoph Frei, Secretary General of the Council said: "Our survey shows that energy leaders face and acknowledge disruptive change. The Issues Monitor illustrates that innovation issues such as digitalisation, decentralisation, innovative market design or electric storage rapidly gain traction, while a more difficult growth context and new physical and digital risks are posing ever greater threats to the energy sector... five years ago these issues were far from being a priority."

THE ENERGY INDUSTRY TIMES is published by Man in Black Media • www.mibmedia.com • Editor-in-Chief: Junior Isles • For all enquiries email: enquiries@teitimes.com

Continued from Page 1

He warned, however, that the UK's withdrawal must not lead to any weakening of the country's environmental protections or ambition.

"The UK needs stable and ambitious policies that will help improve the state of its environment for the benefit of its economy and society and attract more private investment in innovation and green infrastructure," he said.

There is growing concern that Brexit may lead to a slowing of the UK's green economy. Rachel Nutt, Tax Partner and head of Renewable and Sustainable Energy at business advisors' MHA MacIntyre Hudson, said Brexit is creating a challenging and uncertain time for renewable businesses.

"Brexit, and the resulting lack of announcements about future subsidies, which have to date supported much of the sector, is causing a period of inertia and stalling many new projects. It is creating a very challenging and uncertain time for renewable and sustainable energy businesses."

Such concerns appear well founded in light of recent revelations that Britain is preparing to scrap EU green energy targets as part of a bonfire of red tape after Brexit.

The UK is currently committed to getting 15 per cent of all energy from renewable sources such as wind and solar by 2020 but is currently on course to miss the target and incur millions of pounds in fines from the European Union.

Ministers have long been critical of the targets and the *Daily Telegraph* recently reported that government sources said the target, under the EU Renewable Energy Directive, is likely to be scrapped after Brexit.

The news came after papers of a senior civil servant at the Department for International Trade (DIT), allegedly photographed by a passenger on a train, revealed that Britain plans to scale back the importance of climate change after Brexit.

According to the *Telegraph* the note said: "Trade and growth are now priorities for all posts – you will all need to prioritise developing capability in this area.

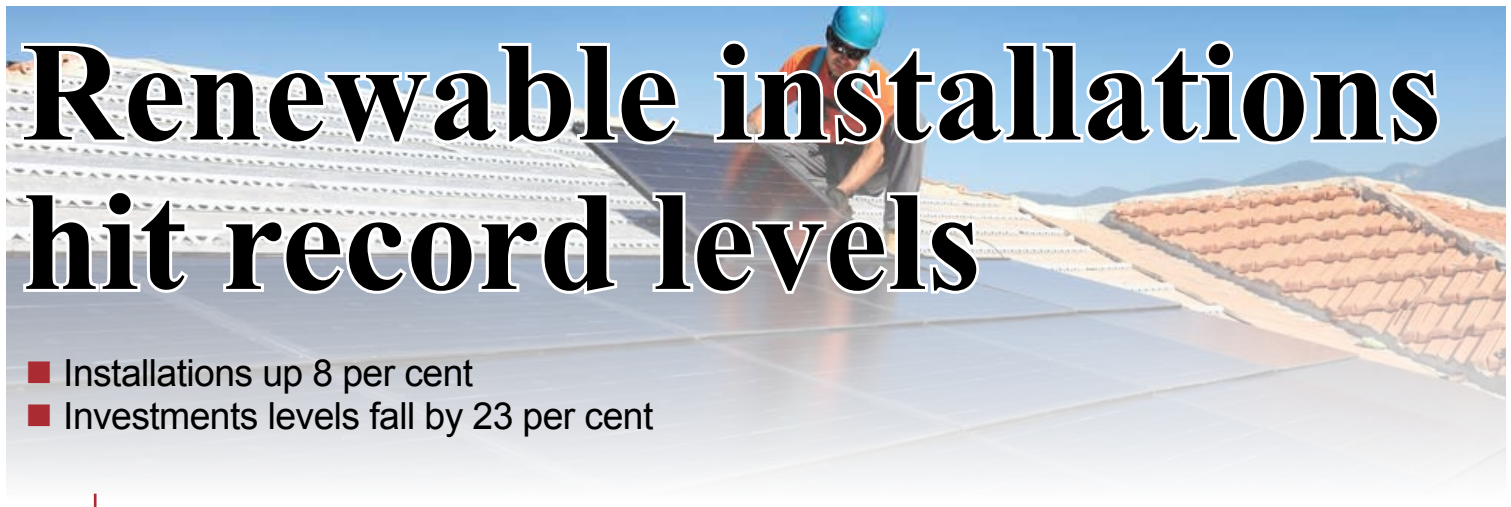
"Some economic security-related work like climate change and illegal wildlife trade will be scaled down."

Paterson would be "happy to see the back of" renewable targets

The claim was substantiated by a similar story reported by Bloomberg. In early April, the news agency revealed that officials at the Treasury and department for Business, Energy and Industrial Strategy have been discussing scrapping the renewables target.

Critics say the target has led to billions of pounds in government subsidies for renewable power sources. The National Audit Office estimates that green energy subsidies will cost every household £110 a year by 2020.

Owen Paterson, a Conservative MP and former Environment Secretary, said: "It's distorting the whole energy market… I would be very happy to see the back of it."



Renewable installations hit record levels

- Installations up 8 per cent
- Investments levels fall by 23 per cent

Junior Isles

Renewable installations hit record levels in 2016, as costs continue to fall, according to a recent report.

The report titled 'Global Trends in Renewable Energy Investment 2017', released by the UN Environment Programme (UN Environment, or UNEP), the Frankfurt School-UNEP Collaborating Centre, and Bloomberg New Energy Finance (BNEF), finds that wind, solar, biomass and waste-to-energy, geothermal, small hydro and marine sources added 138.5 GW to global power capacity in 2016, up 8 per cent from the 127.5 GW added in 2015.

At the same time, the report indicates that the cost of clean technology continues to fall. The world added record levels of renewable energy capacity in 2016, at an investment level 23 per cent lower than the previous year.

The trend of lower investment driven by falling costs looks set to continue, based on figures reported for the first quarter of 2017. According to BNEF, Q1 2017 total investment was $53.6 billion, down 17 per cent in annual terms and 7 per cent in quarterly terms.

BNEF says the world installed more capacity in the first quarter for fewer dollars because of the lower average capital costs per megawatt for wind and solar. This contributed to the weaker figure for the quarter, while BNEF also points to a drop in offshore wind financings to $4.6 billion from $11.5 billion in Q1 2016 as another factor. The US and China, the two biggest clean energy markets, saw investments decrease by 24 per cent and 11 per cent, respectively.

The International Renewable Energy Agency (Irena) also said 2016 was a record year for renewables. According to its 'Renewable Energy Capacity Statistics 2017' report, global renewable energy generation capacity increased by 161 GW. Growth was led by solar with a record 71 GW of new solar energy. Last year marked the first time since 2013 that solar growth outpaced wind energy.

Despite this strong solar growth experts argue that the technology has even greater potential. A recent scientific paper – 'Terawatt-Scale Photovoltaics: Trajectories and Challenges' – published by the Global Alliance of Solar Energy Research Institutes (GASERI) claims the most optimistic projections have under-represented the actual deployment of PV over the last decade and says that a trajectory to install 5-10 TW of PV capacity by 2030 is realistic.

Such predictions continue to fuel arguments that a total transition to renewable is possible. The Renewable Energy Policy Network for the 21st Century (REN21) recently published a report indicating that an energy system completely based on renewables is achievable by 2050.

A report called 'Renewables Global Futures Report: Great debates towards 100 per cent renewable energy' claims that over 70 per cent of the experts interviewed in compiling the data expressed the view that a global transition to 100 per cent renewable energy is both feasible and realistic, with European and Australian experts most strongly supporting this view.

At a UN meeting in New York, USA, in April, a joint World Bank and International Energy Agency report noted that the pace of progress on renewables – along with energy efficiency and electricity access – was not fast enough to meet UN Sustainability Development Goals.

The Global Tracking Framework (GTF) report launched at the opening of the Sustainable Energy for All Forum said renewable energy investment would need to increase by an estimated factor of 2-3, while energy efficiency investment would need to increase by a factor of 3-6. To reach universal access by 2030, the report suggests that a five-fold increase would be needed.

Former climate chief targets 2020 as critical turning point

Christiana Figueres, former Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC), has identified the year 2020 as a game changing opportunity to turn the tide on the devastating impacts of carbon emissions.

Ms Figueres convened a meeting with a group of leading climate and business experts in London last month to encourage urgent action in the next three years. The aim of the campaign, known as Mission 2020, is to protect the remaining window of opportunity to protect vulnerable populations from the worst impacts of climate change and safeguard the achievement of the Sustainable Development Goals.

Speaking at the launch, Figueres stressed the mission was a "call to collective intentionality". She said: "We had a call of collective intentionality with the Paris Agreement; now we need a another wave of collective intentionality to make sure that we do not pass the 2020 milestone as being the moment at which we truly bend the curve and show the world that we have begun to reduce emissions."

Drawing on findings from a newly published report – '2020: The Climate Turning Point' – the campaign will highlight why the 2020 turning point is necessary, and importantly how it can be realistically achieved, thanks to exponentially growing climate action. The new report, a collaboration between Yale University, Carbon Tracker and Climate Action Tracker (a consortium of Ecofys, New Climate Institute and Climate Analytics), with a contribution by the Potsdam Institute for Climate Impact Research, summarises the most up to date scientific basis for urgent action to reduce carbon emissions and provides a roadmap of action to 2020.

Figueres noted that while the goal is challenging, progress is being made. "Is it challenging from where we are today? Absolutely. But we are on our way. For the last three years, we have been at flat emissions globally, while we have continued to increase GDP by at least 2-3 per cent a year.

"That doesn't mean we have irreversibly decoupled greenhouse gas from GDP but it does mean we are on our way, that we can do it and can accelerate it."

According to Figueres the transformation, which is evidenced by the start of the decoupling, is necessary for three key reasons.

The first is the science, which Figueres says shows the world can only emit a further 800 Gt of CO_2 before reaching the point at which irreversible climate change will be reached. "At the current rate of 40 Gt/year, we only have 20 years at the current level of emissions," she noted. "This is why science says we need to bend the curve by 2020 so that we can achieve a decarbonised economy by 2050."

Figueres added that the transformation was also "advisable" due to the multiple benefits that a decarbonised economy brings. These include improved health, transportation, more liveable cities, better energy security, as well as better food and water security.

The third message experts aimed to deliver during the campaign launch is that the goal is achievable. Figueres said that in the next three years, businesses, investors and policymakers need to take "bold, but achievable steps" so that major milestones are reached by 2020. Six sectors were identified: energy, where renewables must "outcompete" fossil fuels as new electricity sources worldwide; transport; infrastructure; land use; industry; and finance. The Mission estimates that at least $1 trillion needs to be invested in clean technologies globally by 2020.

Speaking as part of the expert panel at the launch, Professor Lord Nicholas Stern, Chair of the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science and President of the British Academy, said: "This report correctly identifies 2020 as a key milestone which will indicate whether we are on the path to realising the goals of the Paris Agreement. If the Paris target of holding global temperature increase to "well below 2°C" is to be met, there must be an acceleration around the world of the transition to low-carbon growth and development."

Trump roll-back of CPP will not help coal

An Executive Order (EO) signed by US President Donald Trump to roll back the former administration's Clean Power Plan (CPP) will not help revive the country's beleaguered coal sector or reverse the move towards clean power generation.

Results of a recent survey of utility executives show that only 4 per cent of executives believe there will be a moderate or significant increase in coal use as part of their utility power mix within the next decade. Moreover, some 27 per cent believe that coal use will decrease moderately, and 52 per cent believe it will decrease significantly.

The survey was an online test taken by over 600 electric utility employees in the US and Canada. Notably, 66 per cent said there would be moderate or significant growth in utility-scale solar. Distributed generation and energy storage were also seen as major growth sectors.

Yet although the new EO is unlikely to reverse existing trends in renewables, some believe it will most certainly lead to the US missing its 2025 Paris Agreement commitment.

Climate Action Tracker (CAT) said in New York last month that the Order, if carried out in full, will result in 2025 and 2030 emissions in the US that are roughly similar to those today. To meet its Intended Nationally Determined Contribution under the Paris Agreement the US needs to achieve a 13 per cent decrease in emissions on 2014 levels.

Westinghouse woes trouble AP1000 plants

- Project owners examine options for projects
- Toshiba plans restructuring

Siân Crampsie

US utilities building new nuclear power plants say they are committed to finishing the projects in spite of financial problems at Westinghouse.

State-owned utility Santee Cooper and SCANA Corp. are partners on the AP1000 nuclear project at the V.C. Summer Nuclear Station in South Carolina, while Southern Co is building two AP1000 units at the Vogtle plant in Georgia.

Both projects are already behind schedule and over budget, and Westinghouse's Chapter 11 bankruptcy filing at the end of March is likely to be a further challenge.

Westinghouse said in March that it had reached agreements with the owners of the AP1000 projects "to continue these projects during an initial assessment period". However, the increase in risks faced by the utilities, including an increased likelihood of disruptions to construction, has been noted by ratings agencies.

Westinghouse is building the four new AP1000 units in South Carolina and Georgia under fixed price engineering, procurement and construction (EPC) contracts, with guaranteed completion dates and associated liquidated damage provisions that materially shift the risks of future cost overruns and delays to Westinghouse.

Both projects are behind schedule and over budget – Vogtle 3 & 4 by around $7 billion and VC Summer 2 & 3 by about $5 billion. There are now legal questions around whether the utilities that own the plants will have to stump up more money to complete the plants, according to analysts.

Owners of both plants have already received approvals to raise utility rates in their respective areas to fund construction of the new nuclear units, and further cost liabilities would mean more rate increases in Georgia and South Carolina.

Southern Co. subsidiary Georgia Power said that it was working with Westinghouse to maintain momentum at the Vogtle site. It added in a statement that it would seek to hold Westinghouse, and parent company Toshiba, accountable.

Both Georgia Power and SCANA Corp. are reported to be considering their options for the nuclear projects, according to local reports. Options include leaving one or both units at their respective sites unfinished, and finding new contractors.

Westinghouse has embarked on a strategic reorganisation to "protect its core business" and "resolve [its] AP1000 challenges". Toshiba announced at the end of April that it is also planning to split its business into four units in order to overcome the financial challenges brought upon it by Westinghouse.

Toshiba lost $4.8 billion in the first three quarters of 2016, including losses from Westinghouse. It will create four in-house companies as wholly-owned subsidiaries to help maximise the value of its business operations.

SoCalEd unveils hybrid innovation

- Battery boosts peaker solution
- Younicos starts up Denver battery storage

Hybrid systems combining the use of batteries and gas turbines could play an important role in helping utilities meet the demands of variable renewable energy generation, according to GE.

The engineering firm has unveiled the world's first battery-gas turbine system in California, USA, and says that the unit will help Southern California Edison (SoCalEd) to increase renewable energy generation by providing quick start, fast ramping capabilities when they are needed.

The unit integrates a 10 MW/4.3 MWh battery energy storage system capable of immediately providing power with a 50 MW GE LM6000 aeroderivative gas turbine.

"The new system will help SoCalEd better utilise the resources on the grid, provide enhanced reliability, reduce environmental impact, and reduce cost for our operations and for our customers," said SoCalEd President Ron Nichols. "This technology also allows us to continue to expand our use of solar, wind and other renewable resources."

A groundbreaking control system lies at the heart of the hybrid unit, seamlessly blending output between the battery and the gas turbine, GE said. The innovative combination of technologies, along with emission controls, provides enhanced flexibility in the operation of the peaker while at the same time reducing greenhouse gas emissions and air pollution by 60 per cent, it added.

- Younicos has commissioned a 1 MW/2 MWh lithium ion battery system in Colorado, USA, in partnership with Panasonic and Xcel Energy. The system comprises four Younicos Y.Cubes connected to the Xcel Energy power grid as well as two PV systems. The project is part of a microgrid project at the Peña Station NEXT development in Denver.

Dominica sets up renewables projects

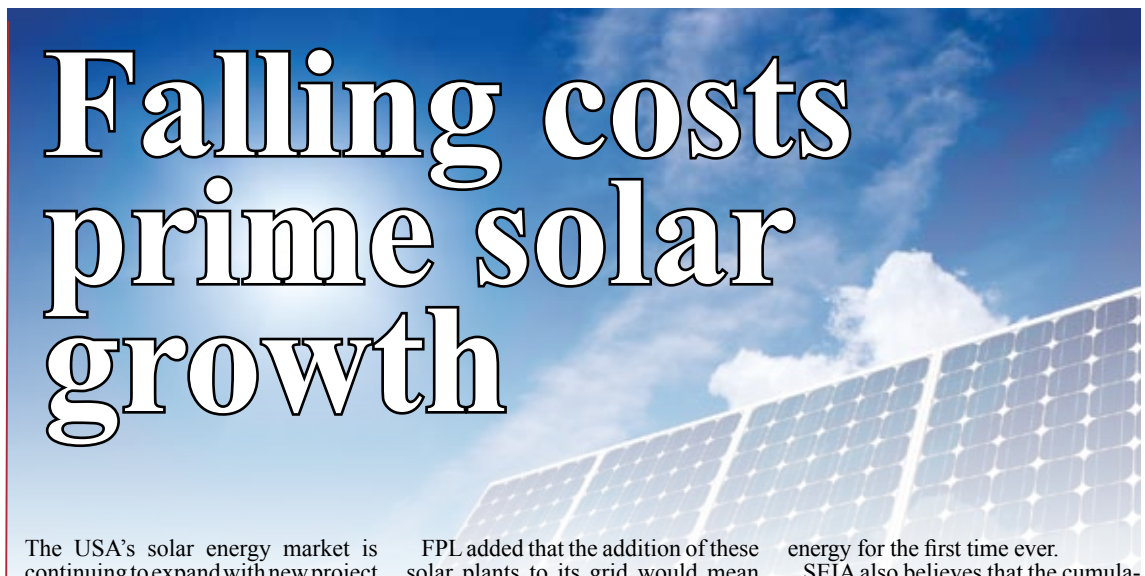
The government of the Dominican Republic wants the country's power sector to add 361 MW of renewable energy to the grid by 2020.

The country's Minister of Energy and Mines, Antonio Isa Conde, wants renewable energy to account for 34.8 per cent of the installed capacity in the National Interconnected Electricity System (SENI). Currently the country has an installed renewable energy capacity of around 195 MW, not including 750 MW of hydropower capacity.

New renewable energy capacity will be added to the Dominican Republic's grid in the form of eight new projects, which require some $780 million in investment.

The projects include eight solar farms with a combined capacity of 133 MW, and five wind farms with a combined capacity of 228 MW. They will start operating in 2018.

Falling costs prime solar growth



The USA's solar energy market is continuing to expand with new project announcements from key industry players.

Florida Power & Light (FPL) has announced plans to develop some 1.5 GW of solar capacity across the state of Florida in the next seven years.

The utility's proposed projects will add to its recently announced plans for eight solar plants in the state with a combined total capacity of 600 MW. Construction is expected to start in 2019 and will be completed by the end of 2023, FPL said.

FPL added that the addition of these solar plants to its grid would mean that solar energy would exceed the contribution made to its energy mix by oil and coal combined within three years.

It said that the project would be among the lowest cost solar plants ever built in the USA.

In March the Solar Energy Industries Association (SEIA) said that the US solar market had its biggest year in 2016, nearly doubling its previous record and adding more electric generating capacity than any other source of energy for the first time ever.

SEIA also believes that the cumulative US solar market will nearly triple in size over the next five years. It forecasts that 13.2 GW of solar PV will be installed in the USA in 2017, a ten per cent drop from 2016. A growing number of US states are reaching grid parity for solar installations thanks to falling solar systems costs, SEIA said.

In the northeast, Current, a subsidiary of GE, announced that it is developing several solar carport and ground-mounted projects across six states.

Mexico converts waste

Up to five waste-to-energy plants are to be built in Mexico as the country seeks to improve the green credentials of its energy sector.

EAWC Technologies has signed an agreement with Mexican firm Tecnologías Verdes to build a WTE plant in the southern state of Chiapas. It will ultimately build five plants in the state, it said in a statement.

The agreement is a revision of one signed by the two companies in 2015. Orders for the five plants are expected to provide over $300 million in equipment sales alone, while related royalties for the use of the company's licensed technology would provide some $90 million/y in fees for 15 years starting in 2019, EAWC said.

The company plans to finance construction of the projects by issuing bonds secured by energy contracts.

Mexico's biomass and WTE sectors are growing, with 11 of the country's 32 states operating biomass plants. Recently the government in Mexico City said it was planning to launch tenders for WTE plants.

The country's renewable energy sector also continues to grow with new solar and wind projects getting under way.

In March Enel said it had started construction of a 754 MW solar plant as well as a 200 MW wind farm in Mexico.

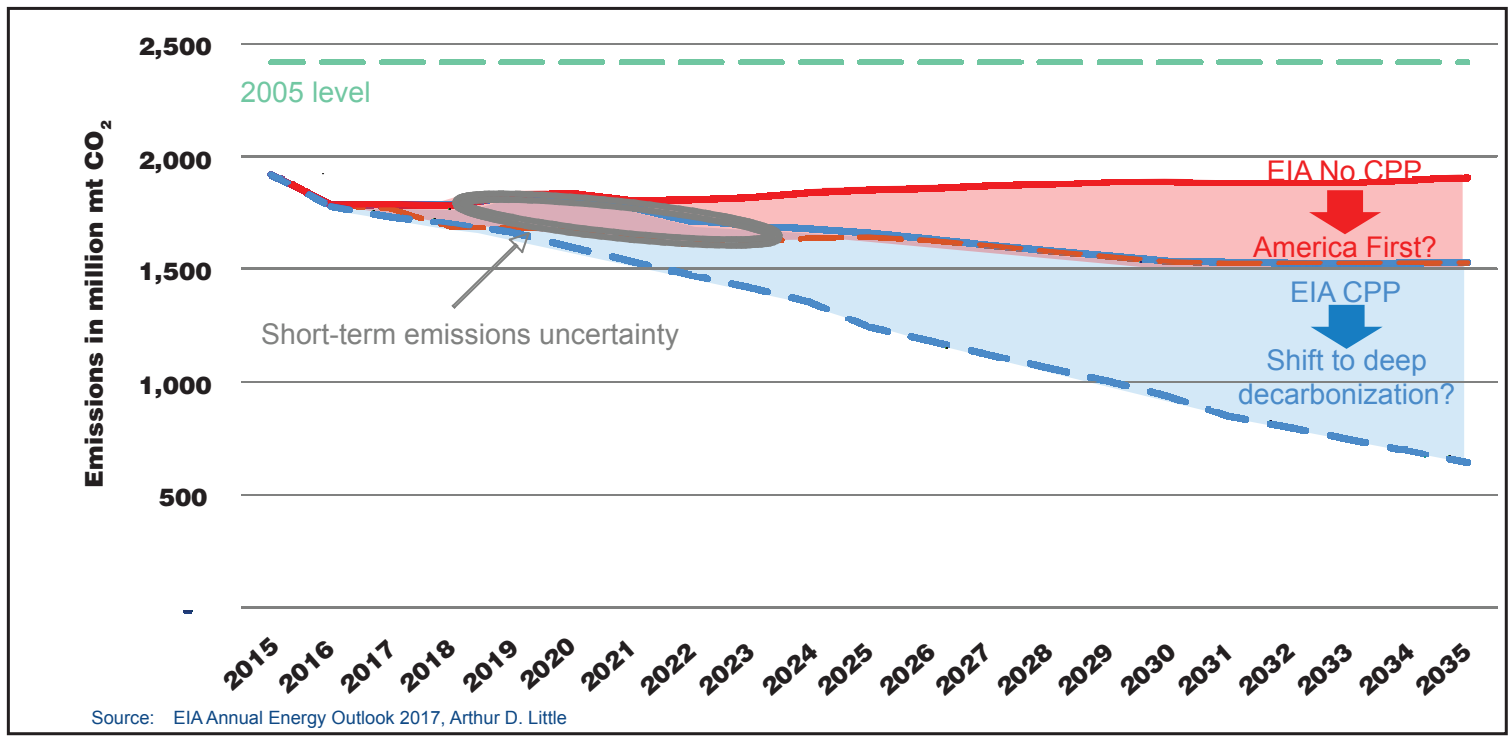
The Villanueva PV project will comprise two solar farms – one of 427 MW and one of 327 MW – in Coahuila state and will start operating in the second half of 2018. It will be the largest solar project on the continent as well as in Enel's portfolio.

Enel's Amistad wind farm will require a total investment of $300 million and will also be constructed in Coahuila state.

In March Iberdrola announced plans to develop a 220 MW wind farm to help meet the energy needs of Mexican brewer Grupo Modelo.

Will "America first" make carbon reduction last?

As US President Donald Trump concludes his first 100 days in office, global regulators and industry experts are questioning how the US power sector will respond to Trump's "America First Energy Plan", and whether it will achieve significant carbon reduction under an administration emphasising low cost supply and domestic energy sources, specifically coal, shale oil and shale gas. **Yvonne Fuller, Kirsty Ingham** and **Paola Carvajal** at Arthur D. Little.



Source: EIA Annual Energy Outlook 2017, Arthur D. Little

Historical emissions from natural gas and renewables

The administration of new US President Donald Trump has made no clear mention of either increasing renewable generation capacity or in limiting greenhouse gas emissions. Despite calls from the EU and China not to abandon the decarbonisation goal, speculation is ripe that Trump's energy policies will be a major shift from the US' recent approach, and a potential U-turn away from its previous commitment on climate change.

While we can predict that some recent carbon reduction legislation, such as the previous administration's Clean Power Plan (CPP), and commitment to the Paris Agreement (COP-21) may fall casualty to anticipated policy actions, the future for carbon reductions in the power sector is not as gloomy as many fear – largely due to the trajectory the industry is already on and market forces that will favour continued investment in greater diversity of energy sources.

The Trump administration's approach to the traditional energy trilemma – the challenge of balancing cheap, secure, and clean energy – appears set to heavily favour the low cost and secure aspects of domestic energy supply at the expense of any focus on carbon emissions. There is no doubt that there is an abundance of coal, oil and gas in the US unconventional hydrocarbon production methods have been a game-changer, and technology improvements continue to reduce the cost of extraction. But renewable power is already being proven to be a cost-competitive energy source, and an additional provider of domestic energy supply and potential economic growth, a view supported by energy giants such as Shell, which recently reiterated its intention to invest beyond fossil fuels.

As the renewable energy sector continues to outperform expectations, all indications show that a combination of renewables plus natural gas can deliver a low cost, low carbon, secure energy future for the US even with considerably scaled back government intervention.

The cost of renewables has dropped far faster than anyone expected, with solar photovoltaic (PV) costs falling by 70 per cent in the last five years, and a 15-25 per cent reduction in onshore and offshore wind. Even without subsidies, PV and onshore wind are now competitive with conventional power sources in many areas of the US, and costs continue to fall.

Energy institutions have consistently underestimated the capacity of renewable energy sources like wind and solar PV in the US. For instance, the 2011 *Annual Energy Outlook* (AEO) projected a 2035 PV installed capacity level, which had already been exceeded by 2013. The latest AEO reports project renewable capacity to double by 2040, though these figures still look conservative for an industry that has seen installed capacity increase by 30 per cent in the last five years.

The power industry has long highlighted concerns about grid integration as a major barrier to large scale integration of renewables in the energy mix. They cite the need for substantial quantities of spinning reserve as "back-up" to maintain system balance, as well as additional costs from maintaining reserve plant and/or storage and for the extra network reinforcement needed to cope with the fluctuations in renewable generation supply.

Our review suggests that the total back-up capacity required is relatively modest, at around 5 per cent when renewables make up a third of the energy mix, and around 10 per cent if renewables reach 50 per cent penetration. This back-up capacity can be provided by a mix of peaking plant, storage and demand-side response.

However, despite the growth in renewables, it has been natural gas that has driven recent US emissions reductions. Natural gas contains less carbon per energy unit than coal, and the power production process itself is twice as efficient – producing half the carbon emissions per TWh of electricity. The abundance of low cost natural gas already drives a substantial part of US efforts to reduce greenhouse gas emissions, mainly through the replacement of older coal fired power stations. The emissions impact of coal switching to natural gas in the power sector outweighs the impact of renewables to date.

Despite recent decreases in installed capacity and output, coal fired generation remains a major component in the mix, leaving significant opportunity for coal replacement by natural gas and further emissions reductions.

Natural gas turbines also combine relatively low cost, high capacities, and high ramp rate capability, giving them the flexibility to complement renewables. They therefore play a critical role in enabling faster renewables growth.

Given the growth of both natural gas and renewables, an important question is: how much will a shift in national energy policy actually impact carbon emission reductions over the next decade? As it turns out, not very much. Based on our analysis of projections from the Energy Information Administration (EIA), emissions levels continue to drop whether or not the US continues to have decarbonisation regulations.

First, let's explore a scenario in which focused political will were deployed significantly to reduce carbon emissions. This would strengthen the type of renewable energy subsidies, tax breaks, regulations, and R&D investment supported by the previous administration. In this scenario, large, high emission, centralised coal plants would be rare, and instead, the generation park would consist of an array of smaller, more efficient and highly distributed generation assets. Solar PV panels and wind turbines would be commonplace and storage technologies, at all scales, widely deployed. In this scenario, renewables penetration would be 44 per cent by 2035. Demand side management, energy efficiency measures and smart grid deployment would also continue to grow.

Crucially, in the background of any low carbon scenario, supporting the growth of renewables, would be fast-ramping gas turbines (OCGT or CCGT or a mix) supplying both a large percentage of centrally produced power, and playing a critical role in stabilising the grid and balancing fluctuations in renewable power output. Optimisation and aggregation of the assets available to the system would become key, in place of centralised dispatch.

In this scenario, by 2030 emissions could be reduced by 60 per cent on 2005 levels, representing a substantial shift towards a low carbon future in the US power sector.

In contrast, the only indication that the current administration's America First Energy Plan will consider carbon emissions in future policy is the mention of clean coal technologies. These technologies have failed to be adopted in the past due to high costs and questionable fuel efficiency. Furthermore, the executive order issued in March abandons some climate change regulatory actions from the previous administration such as the Power Sector Pollution Standards and the obligation for hydrocarbon producers to report methane emissions.

In addition, it eliminates the Interagency Working Group on Social Cost of Greenhouse Gases and promises a review of the Clean Power Plan. Despite this policy shift away from carbon reduction regulation, our analysis suggests that significant carbon emissions reductions can continue, due to a combination of factors.

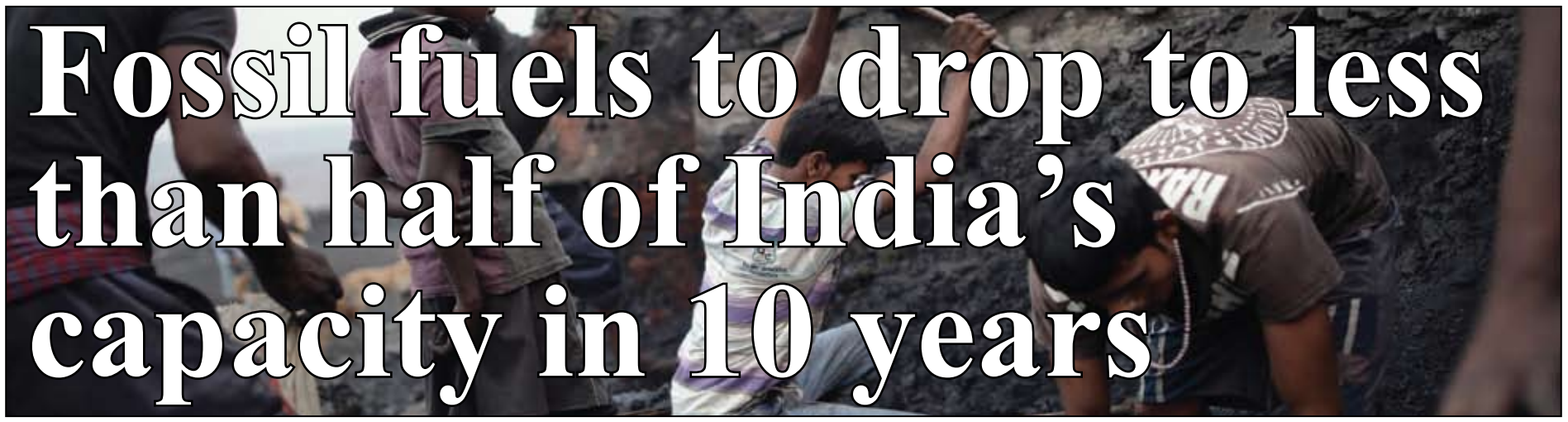
First, previous government policy has already set the wheels in motion. Adoption of renewables has been promoted, capacity has been built, infrastructure has been strengthened, more projects are under development, and costs have fallen. At least in the short term, it is hard to see how the trajectory for growing renewable energy capacity will stall.

Next, state-level energy policies are likely to continue promoting the growth of renewable energy sources, even if federal level supports are scaled back. For example, in 2016 California passed SB-32 to reduce carbon emissions to 40 per cent below 1990 levels by 2030. As the world's sixth largest economy, Californian policy will have a notable effect on US emissions.

Finally, market forces will work to see natural gas continue to displace coal. Natural gas is the critical enabler of the US' low carbon economy, at least in the mid-term. And the shale gas revolution means there will be plenty of low cost gas in North America for the next few decades, even if significant volumes of gas are exported.

Given these factors, even under Trump's "America First" policy, we forecast 2030 carbon emissions to be 36 per cent below 2005 levels. In this scenario, we assume that renewables growth stalls post-2020, nuclear capacity remains stable, and natural gas continues to displace coal over the next 20 years. We have also assumed that electricity demand is unchanged from the EIA reference case.

As details of President Trump's energy policy are confirmed, further scenarios will emerge. Currently it appears likely that support for renewables will end, and fossil fuels will have to compete amongst themselves on a level playing field. The Trump administration will most likely reduce federal level support for decarbonisation of the power sector. Despite this, our analysis suggests that carbon emissions will continue to reduce, suggesting that an economic tipping point in favour of low carbon technologies has already been reached.



Fossil fuels to drop to less than half of India's capacity in 10 years

■ Renewable capacity to hit 275 GW in 2027 ■ Inefficient coal plant replacements identified

Syed Ali

Fossil fuels could represent less than half of India's installed generating capacity in 10 years time. According to a draft of the third National Electricity Plan (NEP3) renewables, nuclear and large hydroelectric power plants will account for more than 56.5 per cent of the country's capacity by 2027.

The draft notes that if India achieves its target to install 175 GW of renewable energy capacity by 2022 – as committed under the 2015 Paris Agreement – it will not need to install, at least until 2027, any more coal fired capacity than the 50 GW currently under construction.

NEP3, published by the Ministry of Power every five years, outlines how the government expects the electricity sector to develop over the five years from 2017 to 2022, as well as the subsequent five years to 2027.

When the draft was released, India had installed just over 50 GW of renewable power capacity, of which wind energy made up 57.4 per cent and solar 18 per cent. This gave renewables a 15 per cent share in total installed capacity of just over 314 GW, while coal made up 60 per cent – the remainder being large hydropower, nuclear, gas and diesel.

Renewables will have to scale rapidly to meet a national target set in 2015 to increase capacity to 175 GW by 2022 – 100 GW from solar, 60 GW from wind and the remainder from sources such as biofuels and biomass. In an upbeat forecast, however, the Ministry predicts that not only will the 2022 target be achieved, renewable power capacity will reach 275 GW in 2027.

In April, Prime Minister Narendra Modi's government moved to step up the pace of auctioning power purchase contracts for wind energy plants, building on a contest that reaped record-low prices for solar farms earlier in the month.

The government plans to offer deals covering almost 4 GW of wind capacity in the current fiscal year ending March 2018 in addition to 750 GW of solar capacity it will tender in May, Ashvini Kumar, Managing Director at Solar Energy Corp. of India, the country's implementing agency for renewable targets, told reporters in New Delhi.

In a separate announcement at the start of April, the European Investment Bank offered a €200 million loan to support the development of large-scale solar projects in India. The loan is part of a total support of €650 million for five different large-scale PV solar projects.

At the same time, investments are also being made in the grid to accommodate the increase in wind and solar. In late March, the Asian Development Bank (ADB) approved a $175 million loan to Power Grid Corporation to expand its solar energy transmission network in the country. The project funding will improve the capacity and efficiency of interstate transmission networks, particularly in transmitting the electricity generated from new solar parks to the national grid, an ADB statement said.

Under the NEP3 forecasts, the 2022-27 period requires the addition of about 44 GW of coal-based capacity to meet projected demand, a requirement that would be adequately met by the 50 GW that will come online during 2017-22. This leaves India with 6 GW of extra capacity.

The NEP's projections for coal are different from India's Intended Nationally Determined Contributions (INDC), which suggested the country would require 100 GW, and perhaps as much as 300 GW, of additional coal-fired capacity by 2030. The downgrading of coal expansion is not unexpected because rapid expansion of renewables means fossil fuel-based power plants are currently under-utilised.

The Ministry's predictions on coal use, however, differ from those of the International Energy Agency (IEA), which says India will witness massive growth in coal-fired capacity, with 438 GW of cumulative capacity by 2040. It assumes that the country's power system would quadruple in size to keep up with demand increasing by five per cent every year.

NEP3 agrees with the IEA's projections about growth in India's coal capacity up to 2022, reflecting the 50 GW of capacity currently under construction, but suggests the IEA's projections for the post-2022 scenario, made two years ago, may need to be adjusted downwards.

India is also taking steps to improve the efficiency of its coal fired fleet. Notably, all coal based capacity additions during 13th Plan shall be through supercritical units.

In April the government identified old, inefficient coal fired power projects totalling 7738 MW capacity for replacement with high efficiency supercritical plants with a capacity of 18 560 MW.

India's efforts to improve the overall efficiency of its power sector received a boost last month when Power and Renewable Energy Minister Piyush Goyal and the UK Secretary of State for Business, Energy and Industrial Strategy, Greg Clark, agreed a collaboration that will focus on innovation in smart technology to reduce power sector losses and clean energy finance for bolstering bilateral energy ties.

The India-UK 'Energy for Growth' dialogue takes forward the commitment of Prime Minister Narendra Modi and UK Prime Minister Theresa May for an enhanced energy partnership between the countries.

The two countries will focus on work to accelerate deployment of renewable energy and its integration with the grid; support for increased energy efficiency; and enhanced energy access for strengthening ties.

■ Fortum has commissioned a 70 MW solar plant at Bhadla solar park in Rajasthan. It is Fortum's third and so far biggest commissioned solar energy project.

PLN to issue renewables tender to meet government target

State-owned electricity firm PLN plans to hold a tender shortly for power plants generating renewable energy in a bid to meet the government's goal to supply 23 per cent of the national energy mix from renewable sources by 2025.

"The tender will be held in early or mid-May at the latest, in accordance with PLN's timeline. The company is currently conducting a feasibility study for plants using renewable energy," said Rida Mulyana, the Energy and Mineral Resources Ministry's new and renewable energy director general.

According to PLN's electricity procurement business plan (RUPTL) for the 2017-2026 period, the company plans to acquire an additional 632 MW of electricity from renewable sources this year, almost half of which will come from geothermal power plants.

In 2026, PLN plans to acquire an additional 21 560 MW of electricity from renewable energy sources, with 58 per cent of the total coming from hydro power plants.

Several companies have shown interest in joining the tender, including energy firm PT Terregra Asia Energy. "We are currently waiting for the issuance of the technical guidance to join the tender. We have registered ourselves to be involved in it," Terregra Vice President Director Lasman Citra said.

Notably at the end of March, six firms signed an agreement with state-owned electricity company PLN to develop electricity plants using solar energy with total capacity of 45 MW.

Under the RUPTL, Indonesia has set a national electricity capacity of 125 GW by 2025. The target is higher than the one listed in the National Energy Policy (KEN), issued in 2014, which set a national capacity target of 115 GW by 2025.

The total target also includes the government's ambitious 35 GW programme, said the Energy and Mineral Resources Ministry's acting electricity director general, Rida Mulyana.

"We have set an electricity growth target of around 8.3 per cent within the next decade," he said during a meeting held at the ministry in Jakarta.

"Furthermore, we will encourage more growth outside of Java and Bali, and have set a national capacity target of 75 GW in 2019 and 125 GW in 2025, higher than the initial KEN target of 115 GW."

In total, PLN has set a target to construct an additional 77 GW of power plants by 2025.

■ Sumitomo has commenced work on the Tanjung Jati B coal fired power plant unit 5 and 6 expansion project. The expansion involves the addition of two ultra-supercritical coal fired units, each with a capacity of 1000 MW.

Vietnam approves solar tariffs

Vietnam's solar sector has received a boost with the Prime Minister's official approval of the issuance of Decision No. 11/2017/QD-TTg: the supporting regime for the development of solar power projects in Vietnam.

With this decision, Vietnam introduces a feed-in tariff (FIT) for grid-connected PV power plants of VND2086 (9.35 cents/kWh) with a 20-year power purchase agreement (PPA). Electricity of Vietnam (EVN), the sole electricity buyer is responsible for buying the entire output from on-grid solar projects with priority given to deploy the full generating capacity of the system. The government will issue a standard PPA that all power sales have to comply with.

The regulation will enter into force, commencing June 1, 2017, till 30 June 2019 in the initial period.

Solar is beginning to gain traction in the country. At the end of March, the Central Power Corporation (CPC), under EVN, will build a solar plant project with a capacity of 50 MW and solar farms in the south-central coastal province of Khanh Hoa.

The province said 10 investors have registered to develop solar power projects in Khánh Hòa, with a total capacity of 2000 MW.

■ PetroVietnam Power Corporation (PV Power), a member company of the Vietnam Oil and Gas Group (PetroVietnam) and currently the second largest power supplier in Vietnam, has announced that it will make its initial public offering (IPO) this August. While the amount of shares offered for the public sale accounts for just 3-4 per cent of its capital, the company also plans to sell a 45 per cent stake to long-term strategic investors this year and can up the stake to 60 per cent, depending on the approval of the government.

EDF pours Hinkley concrete

Nuclear power projects are starting to make progress in the UK but Westinghouse's bankruptcy has highlighted the risks of undertaking such mammoth projects.

Siân Crampsie

EDF Energy has marked a milestone in the development of the Hinkley Point C nuclear power plant by pouring concrete for some of the first permanent structures at the site.

The pouring of concrete for the plant's power station galleries commenced after the UK's Office for Nuclear Regulation (ONR) last month granted the first consent for construction at Hinkley Point C to start.

The milestone was welcome news for EDF following months of speculation about the firm's ability to fund the project. However, it came as Toshiba announced that its nuclear arm, Westinghouse, had filed for Chapter 11 bankruptcy in the USA.

Westinghouse's financial woes, and their impact on Toshiba's balance sheet, have thrown the development of the Moorside nuclear power plant in Cumbria into doubt.

They have also highlighted the risks associated with the development of large-scale nuclear infrastructure projects.

EDF has been able to progress its Hinkley nuclear power project thanks to the financial backing of China General Nuclear (CGN) and the signing of a Contract for Difference with the UK government. A government-backed reorganisation of the French nuclear industry and EDF's finances also enabled the state-owned energy firm to make its final investment decision on Hinkley in 2016.

Toshiba reported a $4.8 billion loss for the three quarters to December 2016, with its poor performance largely the result of cost overruns and delays at four Westinghouse AP1000 nuclear power projects in the USA.

Engie, Toshiba's partner in Moorside's development company NuGeneration (NuGen), has announced its intention to pull out of the project, which would see three Westinghouse AP1000 units built in the northern county.

Toshiba says it will buy Engie's 40 per cent stake in NuGen for approximately €130 million and will continue to look for a new partner for the Moorside project.

South Korea's Kepco is seen as the company's most obvious partner for the project and in April UK business secretary Greg Clark met with senior South Korean government officials and nuclear industry executives in Seoul to discuss Moorside.

Westinghouse said last month that UK regulators have approved its AP1000 design for construction in the UK. Meanwhile Horizon Nuclear Power announced that it has submitted its site application to the ONR to build and operate two Advanced Boiling Water Reactor (ABWR) units at the Wylfa Newydd nuclear power plant on the island of Anglesey, North Wales.

Hitachi-owned Horizon says that it is on track to receive all the necessary permits for Wylfa Newydd by the end of 2018.

The company plans to build a total of 5400 MWe of new nuclear generating capacity in the UK, split between the Anglesey site and a site at Oldbury-on-Severn.

UK urged to relax storage rules

The UK is building its energy storage market and may have to consider regulatory rules governing such projects to encourage investment.

Current rules prevent network companies such as National Grid and distribution network operators (DNOs) from developing and owning storage capacity. However, they believe there is a need for them to be allowed to be more innovative in terms of deploying new technologies in order to help them improve grid operations.

A number of companies have pledged to develop energy storage projects in the UK under the country's capacity market regime. These are mostly battery-based systems and are classed as generation projects for regulatory purposes.

Energy storage schemes can provide a range of benefits to different stakeholders in the electricity market, however, including consumers, generators and network firms.

National Grid has therefore called on the government to remove regulatory limitations on the technology, and free up investment.

Last month Anesco and Limejump announced that they would bring 185 MW of energy storage on line in the UK by the end of 2018, creating the largest portfolio of energy storage projects in the country.

The companies said that Limejump would commercially operate the portfolio, connecting it to its Virtual Power Plant portfolio and enabling it to play an active role in Dynamic Frequency Response.

"As well as aiding grid stability, energy storage can help maximise the use of renewable power being generated, while breeding a more resilient local grid. It's an exciting time for the sector and we predict momentum will continue to grow, as more and more generators look to benefit from the technology."

Anesco and Limejump will enter the UK's next capacity market auction, slated for August 2017.

The UK government is currently consulting on mechanisms for improving the flexibility of the electricity system. In its submission to the consultation, National Grid said that changes to regulations should be made to help the market develop and ensure the electricity sector and consumers can reap the benefits of storage.

■ Eneco and Mitsubishi are to build a 48 MW/50 MWh battery in the German state of Schleswig-Holstein to provide primary reserve and to store extra wind power. The lithium-ion battery will be supplied and integrated by NEC Energy Solutions and is due to start operating by the end of 2017.

Germany selects subsidy-free offshore wind bids

- EnBW, Dong win in latest German auction
- Kriegers Flak subsidy cleared

Dong Energy and EnBW are to build the world's first subsidy-free offshore wind farms after submitting 'zero bids' in Germany's latest auction.

The two companies have been awarded the rights to develop three offshore wind projects in the German North Sea totalling 1380 MW of capacity without subsidy.

In the auction, EnBW won with its bid to develop the 900 MW He Dreiht offshore wind farm. Dong Energy, meanwhile, will build the 240 MW Borkum Riffgrund II West wind farm and the 240 MW OWP West wind farm.

Dong was also awarded a third project, the 110 MW Gode Wind 3 project, based on a bid price of €60/MWh.

Greenpeace said that the zero-subsidy bids marked a "watershed" moment for the renewable energy industry. "Offshore wind has the potential for huge global growth from the USA to Taiwan as the technology massively improves, costs fall and governments wake up to the economic potential," said Hannah Martin, Head of Energy at Greenpeace UK.

Dong and EnBW said that a number of factors had enabled their zero bids, including technological developments that were enabling falling costs in the industry, the location of the wind farms and certain changes in German law.

Dong CEO Samuel Leupold said that the extension of the realisation window to 2024 had helped. "This allows developers to apply the next generation turbine technology, which will support a major step down in costs," said Leupold. "Also, the bid reflects the fact that grid connection is not included."

Offshore wind is taking a growing role in Europe. TenneT reported in March that German offshore wind farms in the North Sea and the Baltic Sea generated 12.09 TWh of electricity in 2016, a 45.7 per cent jump compared to 2015.

The rise in power generated by offshore wind turbines can be attributed to the new capacity grid-connected in 2015 that has reached full production capacity in 2016.

Germany connected 546 offshore wind turbines with a total capacity of 2282.4 MW to the grid in 2015. In 2016, Germany added a further 818 MW of offshore wind capacity, with the total combined capacity reaching 4113 MW by the end of the last year.

■ The European Commission has cleared Denmark's government to provide state aid to the 600 MW Kriegers Flak offshore wind project in the Baltic Sea. Kriegers Flak is being developed by Vattenfall, which will invest €1.3 billion in the project. The Commission said that the project's contribution to green targets outweighed any potential market distortions caused by government support.

Larne CAES wins EU funds

A proposed large-scale energy storage project in Northern Ireland would contribute to system flexibility and stability and facilitate the large-scale penetration of renewables into energy markets, the European Commission has said.

The Larne compressed air energy storage (CAES) project has been awarded a €90 million grant for works under the Connecting Europe Facility (CEF).

Developer Gaelectric said that the award confirmed its belief that grid-scale energy storage was key to attaining a renewable energy-enabled economy and that it looked forward to carrying out further work to "bring the project to fruition".

The Larne CAES would be capable of generating 330 MW of power for periods of 6 to 8 hours and creating 250 MW of demand on the system. It is planned for deep underground salt caverns located in Antrim, Northern Ireland.

South African court halts nuclear plans

- Government procurement plans unlawful
- Ratings agencies downgrade SA to junk status

Siân Crampsie

Plans for South Africa to develop new nuclear power plants are likely to be delayed after a South African court ruled that a number of deals and determinations made by the government were unlawful.

The Western Cape High Court has ruled that two governmental determinations covering the procurement process for 9600 MW of new capacity are unconstitutional and should be set aside. It also said that intergovernmental agreements on nuclear energy signed by South Africa and other countries, including Russia and the USA, were unlawful and should be set aside.

The ruling came just weeks after ratings agency S&P Global downgraded South Africa's credit rating to 'junk' status following ministerial changes made by President Jacob Zuma and concerns over debt, particularly in the energy sector.

The court ruling was made in response to a case brought by Earthlife Africa and other environmental organisations that have campaigned to stop South Africa's nuclear programme.

In 2013 South Africa's government determined that the country would need to procure 9600 MW of nuclear capacity. However this was not officially announced by the government until 2016.

In 2016 it also determined that Eskom should be the main procurer of the nuclear power plants. These determinations are unconstitutional, the court has ruled, because there was no public consultation process.

In addition, intergovernmental agreements signed with the USA in 1994, South Korea in 2010, and Russia in 2014 should be set aside because of delays in tabling them.

South Africa recently started the procurement process for its nuclear power programme with a Request for Information (RFI) that was due to close at the end of April. A Request for Proposals (RFP) is due to be issued later this year.

Eskom has yet to respond to the court ruling. Its own credit status was downgraded after S&P Global's action on South Africa.

S&P Global said that executive changes in government, including the removal of finance minister Pravin Gordhan, would put policy continuity at risk and threaten fiscal outcomes. It added that "contingent liabilities to the state, particularly in the energy sector, are on the rise, and that previous plans to improve the underlying financial position of Eskom may not be implemented in a comprehensive and timely manner".

Higher risks of budgetary slippage will also put upward pressure on South Africa's cost of capital, further dampening already modest growth, S&P added.

There is speculation that President Zuma removed his respected finance minister because of objections from the Treasury over the cost of the nuclear programme.

The nuclear power plant construction programme is likely to cost in the region of $76 billion. South Africa's Department of Energy has said that it would determine the funding model for the nuclear plants once the RFPs had been received.

Ratings agency Fitch, which also downgraded South Africa, said the cabinet reshuffle signalled "a change in policy direction" and would "raise political tensions within the ANC and increase political instability".

Wind firms await Turkish tender

Turkey is preparing to invite bids for 1 GW of wind energy as part of plans to boost domestic energy supplies.

The country's energy ministry says that a reverse auction will take place to award the capacity and has set a deadline of July 27, 2017 for interested parties to apply.

The auction is part of a new system designed to boost Turkey's renewable energy capacity that streamlines the process for allocating land for large-scale renewable energy projects by creating 'renewable energy resource areas' (YEKA).

Turkey held its first YEKA auction – for 1 GW of solar power capacity – in March. That auction was won by a consortium of Hanwha Q Cells and Kalyon Enerji Yatirimlari, which will build the plant in Karapinar, 250 km south of Ankara.

According to a notice in Turkey's Official Gazette, the winning bidder in the wind auction will be able to build capacity in seven separate areas and will sign 15-year power purchase agreements. A ceiling price of $0.070/kWh has been set, which is just below the current feed-in tariff price of $0.073/kWh.

Bidders will also be expected to fulfil local content requirements, including the construction of a local wind turbine factory and employ local personnel.

In March GE announced it had signed a memorandum with wind firms Borusan EnBW Enerji and Fina Enerji, and project developer Özgül Holding to participate in the auction as a consortium.

Hanwha is planning to establish 500 MW of fully integrated PV manufacturing capacity locally in Turkey to support the solar project, which is expected to cost $1.3 billion to build and will be operational within three years.

The new YEKA system is designed to support Turkey's ambitions to develop 20 GW of onshore wind capacity and 3 GW of solar by 2023. It also supports the country's policy of increasing the use of domestic energy supplies to improve energy security in the face of rapidly rising demand.

Turkey's current installed onshore wind energy capacity stands at 6081 MW, according to WindEurope.

Saudi Arabia shortlists first renewables bidders

- International firms qualify in first round
- Second round takes shape

Saudi Arabia is continuing its drive to develop renewable energy capacity.

The country has received over 100 applications from companies for the construction of a 300 MW solar facility and 400 MW of wind power capacity after announcing its first renewables auction in February 2017.

It has also unveiled plans for the 1020 MW round 2 of the National Renewable Energy Programme (NREP).

Saudi Arabia's Renewable Energy Project Development Office (REDPO) has shortlisted 27 applicants for the solar photovoltaic (PV) project, and 24 companies for the wind scheme. Winning bids will be announced in November 2017.

The qualified firms will proceed to the request for proposal (RFP) stage as either "managing members" and "technical members", or both, depending on their experience in delivering independent power producer (IPP) projects of this scale, REPDO said in a statement. It added that parties not qualified can still be involved in both projects as part of a consortium created by a qualified managing member and technical member.

"The market response to the Kingdom's invitation to its first renewable energy projects has been overwhelmingly positive, demonstrating market confidence in our vast renewable energy potential and investment environment," said Khalid Al Falih, Saudi Arabia's Minister of Energy, Industry and Mineral Resources.

Moody's said last month that Saudi Arabia's renewable energy market is set for growth, supported by an abundant solar resource, land availability, an A-rated sovereign credit, and strong economic and strategic logic.

"The government of Saudi Arabia's plans are motivated by a desire to diversify the energy mix and take advantage of the compelling economics of renewables, especially solar, in the country," said Christopher Bredholt, a Moody's Vice President and Senior Analyst.

Firms qualified for the round 1 bids include Acciona, ACWA Power, EDF Energies Nouvelles, Enel Green Power, Engie, Marubeni, Masdar, Gamesa and Mitsui & Co.

For round 2 of the NREP, Saudi Arabia expects to launch request for qualifications (RFQ) in the final quarter of 2017 for a 400 MW wind farm in Doumat Al Jandal and several additional solar projects totalling 620 MW.

Saudi Arabia's electricity demand has grown strongly at an average annual rate of seven per cent over the past 15 years, and the country has set a target of reaching 9.5 GW of renewable energy capacity by 2030.

Mafraq plants close finance

- Plants represent investment of approximately $180 million
- ACWA signs PPA for Risha project

Jordan's efforts to develop its renewable energy sector and improve energy security are yielding results.

Renewable energy developer FRV has announced the financial close of two major solar energy plants – Mafraq 1 and 2 – which were awarded in the second round of Jordan's solar independent power producer (IPP) tender.

The two plants represent a combined investment of approximately $180 million and will start construction shortly in the region of Mafraq. Once completed, they will generate 133.4 MW in total – approximately two per cent of Jordan's total generation capacity.

Mafraq I and Mafraq II will supply power at 6.9 and 7.6 US cents/kWh respectively, prices that are below the average cost of electricity in Jordan.

The solar plants are two of the four schemes awarded in the second round of Jordan's solar independent power producer initiative, which aims to develop 1600 MW of renewable energy by 2020.

Separately, ACWA Power announced recently that it had signed a power purchase agreement (PPA) for the 61.3 MW Risha solar power project in eastern Jordan.

The Risha plants will be developed alongside an existing 150 MW gas turbine plant run by Central Electricity Generating Company (CEGCO), a Jordanian power firm in which both the government of Jordan and ACWA are shareholders.

Under the PPA, the company will sell electricity to Jordan's utility National Electric Power Company (NEPCO) at a tariff of $0.059/kWh – the lowest in the country to date.

LM deal brings blades in-house for GE

GE has closed a deal to buy LM Wind Power, a move it hopes will give it the edge in an increasingly competitive market.

Siân Crampsie

GE says that the acquisition of LM Wind Power will enable it to support the growth of its rapidly expanding wind energy business.

The energy giant last month completed the deal to buy LM Wind from London-based private equity firm Doughty Hanson following regulatory approval from authorities in Europe, the USA, China and Brazil. It says that its wind business is the fastest growing segment of its power generation business and that the €1.5 billion deal will be accretive to earnings in 2018.

"With LM's technology and blade engineering, we are now able to improve the overall performance of our wind turbines, lowering the cost of electricity and increasing the value for our customers," said Jérôme Pécresse, President and CEO of GE Renewable Energy. "Together, we are set to capitalise on the expansion of renewable energy and be a growth engine for GE."

The acquisition of LM Wind will enable GE to bring wind turbine blade design and manufacturing in-house, potentially giving the US firm the edge over its rivals. It could also help GE boost its nascent offshore wind energy business.

LM Wind holds 669 patents covering 160 separate inventions and generates as many as 27 new patent applications annually, GE said in a statement. In 2016, LM Wind unveiled the world's longest blade at 88.4 m long, built for Adwen's 8 MW offshore wind turbine.

"The deal gives us the ability to integrate blade design and production into our wind turbine business, allowing us to compete better in the fastest growing segment of power generation," said Pécresse. "We plan to invest in the LM Wind Power business while integrating digital industrial capabilities to enhance LM Wind Power's offerings. Together, we will become a growth engine for the company and the prototype business for the new digital industrial GE."

LM Wind Power will be run as an individual operating unit within GE Renewable Energy, providing blades for both GE's onshore and offshore wind business units. LM Wind Power will continue to supply blades to the rest of the wind industry, having established protocols and safeguards to protect customers' confidential data.

Sale of RTE stake could help EDF fund Hinkley C

A French state-run bank has purchased a 50 per cent share in network company RTE from EDF in a move designed to help the energy utility finance the construction of a new nuclear power plant.

Caisse des Depots et Consignations (CDC) and its unit CNP Assurances have purchased the 49.9 per cent stake in RTE in a deal valuing the grid operator at €8.2 billion. The deal has been approved by EU competition authorities.

EDF inked the deal with the bank in 2016 after the French government, which owns 80 per cent of EDF, asked it to find a buyer for up to 50 per cent of RTE to allow it to cut debt and raise capital for the construction of the planned Hinkley Point C nuclear power plant in the UK.

EDF will continue to own 50.1 per cent of RTE through a new joint venture, in which CDC will hold 29.9 per cent and CNP Assurances 20 per cent. The new shareholder structure will help RTE to develop its long term investment strategy, which is focused on improving network infrastructure and operations for the clean energy transition.

EDF says that the deal has enabled it to cut its net debt by around €4 billion. It forms a key part of the company's strategy to dispose of around €10 billion of operations by 2020.

SNC Lavalin swoops on Atkins

Canada's SNC-Lavalin is to broaden its global reach and expertise through the acquisition of British engineering firm Atkins.

The two companies have reached an agreement on a C$3.6 billion cash deal for Atkins, which is heavily involved in a number of key infrastructure projects globally, including Hinkley Point C, the UAE's nuclear new build programme, and a number of offshore wind energy projects.

SNC-Lavalin – Canada's largest engineering and construction company – is to buy Atkins for 20.8 pence per share. It says that the deal will position it to win more work in the nuclear sector and deepen its project management, design and engineering capabilities.

The merged company will have a value of C$12.1 billion and employ 53 000 employees, SNC said in a statement. The transaction will "significantly improve" SNC's overall margins and balance its business portfolio, it added.

"By combining two highly complementary businesses, we will increase our depth and breadth of services to position us as a premier partner to public and private sector clients," said Neil Bruce, President & CEO. "It also creates new revenue growth opportunities in key geographies by positioning us to capitalise on increased cross-selling and the opportunity to win and deliver major projects in new regions."

The move by SNC-Lavalin is the latest takeover of a UK firm by a foreign company taking advantage of a weak pound. It is also the latest M&A deal in a consolidating global engineering sector.

In March the Amec Foster Wheeler board recommended a £2.2 billion takeover bid from Wood Group. It also agreed to sell its boiler business to Sumitomo Heavy Industries, Ltd.

Montreal-based SNC-Lavalin believes that it will achieve synergies of C$120 million by the end of 2018 through "eliminating corporate and listing costs, optimising corporate functions and shared services, streamlining IT systems, and office consolidation where appropriate".

UK privatises green bank despite concerns

- GIB will be merged with Macquarie's UK green energy business
- Concern over UK's green energy strategy

The UK government has finalised a deal to sell its Green Investment Bank (GIB) in spite of concerns over the future of the financing vehicle once it is in private hands.

A consortium led by Australian bank Macquarie Group has purchased GIB for £2.3 billion and has pledged to maintain its "green purpose" through new investments and the creation of new investment vehicles.

The Macquarie consortium includes Macquarie European Infrastructure Fund 5 (MEIF5) and Universities Superannuation Scheme (USS). Five independent trustees will hold a "special share" in GIB, giving them the power to approve or reject any proposed change to the bank's green mission.

"We have secured fair value for the UK taxpayer," said Nick Hurd, Climate Change and Industry Minister. "GIB has a well-funded new owner that is committed to the Bank's green mission, with a track record of success in green investment and an ambition to grow the business.

"The UK will benefit from increased investment in our green infrastructure as we make the transition to a green economy."

Green groups remain concerned over the future of GIB in private hands, and the implications of the sale for the UK's green economy. Dr Doug Parr, Policy Director at Greenpeace UK, said that the government had "given away one of our key tools for advancing green technologies" and that the sale of GIB would set the UK back on reaching climate change targets.

Parr added: "Selling a great British success story, which levered private money into eco-projects, to a controversial Australian bank known for asset-stripping, is a disaster."

GIB was launched in 2012 and has won praise for its ability to attract third party capital and support green infrastructure projects. Macquarie says that it will make the bank its primary vehicle for renewable energy investment in the UK and Europe by combining it with its existing UK green energy investment business.

"By combining the Green Investment Bank with the largest infrastructure investor in the world, we will create a market leading platform dedicated to investment in the low carbon economy in the UK and beyond," said Daniel Wong, Head of Macquarie Capital, Europe. "We understand the responsibilities that come with this ownership, and we are fully committed to maintaining its green purpose as we grow the business."

On completion of the deal, GIB will manage or supervise over £4 billion of green infrastructure assets and projects and establish three new investment vehicles: an offshore wind investment vehicle, a low carbon lending platform and a green infrastructure investment platform. Macquarie is also committed to GIB's newly established target of £3 billion of new investment in green energy projects over the next three years.

"We are pleased to see that Macquarie has committed to investing £3 billion over three years to grow the GIB's activities," said Nick Molho, Executive Director of the Aldersgate Group. "This is a promising start.

"Now that the GIB has been fully privatised and the UK can expect to receive less funding from the European Investment Bank post-Brexit, the government must ensure that it has a clear strategy in place to attract private finance to deliver its environmental and low carbon policy objectives."

Americas

Nordex secures Brazil contract

Nordex is to deliver 65 of its AW125/3000 wind turbines for the Lagoa do Barro project in Brazil.

The 195 MW Lagoa do Barro project is composed of eight individual wind farms that will be installed in the state of Piaui in northeastern Brazil. Nordex will deliver and install the turbines from mid-2017.

Areva NP signs Farley deal

Areva NP has signed a contract with Southern Nuclear to provide outage services at the Joseph M. Farley nuclear power plant units 1 and 2 between 2017 and 2021.

Over the course of six outages, Areva NP will provide refueling, steam generator and specialty non-destructive examination services, inspection and reactor coolant pump services that support the Farley plant in providing carbon-free and reliable electricity to the grid in Alabama, USA.

Wärtsilä bags Virgin Islands deal

Wärtsilä is to supply a 21 MW power plant to the US Virgin Islands Water and Power authority.

The order includes three Wärtsilä 34SG-LPG engines running on propane gas. Wärtsilä's scope covers the entire engineering, procurement and construction (EPC) of the project.

The power plant will be located on the island of St. Thomas, and is expected to be operational in early 2018.

Asia-Pacific

GE Predix to improve Nakasode operations

Marubeni Corporation has selected GE's Predix digital power plant solutions for its 100 MW Nakasode power plant, located in Sodegaura city, Chiba Prefecture, Japan.

GE's Asset Performance Management and Operations Optimisation software for predictive maintenance and operational efficiency will be installed on two units of LM6000 PD gas turbine, steam turbine and BoP (balance-of-plant).

Marubeni is considering installing digital 'Internet of Things' software across its entire electric power generation business. "By applying IoT technologies, we hope to achieve more efficient power generation, procurement of electricity, and revenue improvements in the future," said Hirohisa Miyata, Managing Executive Officer, Marubeni.

Sembcorp builds wind business in India

Sembcorp Green Infra, a division of Sembcorp India, has won a bid to build a 250 MW wind farm in Tamil Nadu, India.

The tender was held by Solar Energy Corp. of India, a company owned by the Ministry of New and Renewable Energy.

The project will be conducted in phases and will be fully commissioned in 2019, increasing Sembcorp's portfolio in India, where it has 3.8 GW of thermal and renewable energy under development.

Suzlon wins 50 MW in Karnataka

Suzlon has bagged an order for 50 MW for a wind power project in India's Karnataka state.

Suzlon will supply 24 of its S111 120 m, 2.1 MW wind turbines for its customer. The contract is a repeat order and represents the first commercial installation of the S111 120 m hybrid wind turbine generator.

GE to equip Liang He Kou hydropower project

China Yalong River Hydropower Development Co. Ltd. has contracted GE Renewable Energy to supply six 500 MW generators and auxiliary equipment for the 3000 MW Liang He Kou hydropower plant in Sichuan Province, China.

Under the $56 million contract, GE will supply the equipment and carry out design, installation, manufacturing, commissioning, on-site testing, supervision and other services.

The Ling He Kou dam started construction in 2014. It is one of several plants in a cascade proposed for the Yalong river, including the 3600 MW Jinping 1, 3300 MW Ertan, 2400 MW Guandi, 600 MW Tongzilin, and Jinping 2 plants.

Suzlon bags fifth ReNew order

Suzlon Group has been awarded a fifth order from ReNew Power Ventures for a 100.8 MW wind power project in India.

Suzlon will install 48 of its S111 120 m 2.1 MW wind turbine generators in ReNew Power's Limbwas project in Madhya Pradesh, it said in a statement. It will also provide a comprehensive range of services including operation and maintenance and dedicated lifecycle asset management solutions for an initial period of 10 years.

The project is due to be completed by March 2018.

Valmet to supply Long Phu 1

Valmet is to provide Vietnam Oil and Gas Group with automation technology for the Long Phu 1 thermal power project in Soc Trang Province, Vietnam.

The order was placed by Russia's OJSC Power Machines, the general contractor for the project. Long Phu 1 will comprise two 600 MW coal-fired boilers supplied by Power Machines that run with Valmet's automation technology.

Valmet's delivery will include two Valmet DNA automation systems and a burner management system, a boiler protection system, an information management system and an interface with PLCs for each unit as well as the engineering, factory acceptance testing, commissioning and training.

Included are also energy performance applications, such as boiler performance monitoring, a DNA Sootblowing Manager application, continuous emission monitoring, combustion optimisation and advanced boiler controls.

Siemens works on Vietnam grid

Electricity of Vietnam (EVN) has placed an order with Siemens to supply and install products and systems that will improve the performance of the national transmission grid.

The equipment will be installed in substations distributed throughout the country and in the grid control centres, where it will help increase the grid's failure tolerance, improve its transmission capacity and optimise the expansion of new primary plants.

The goal is to make better use of the existing grid infrastructure and to be able to connect additional loads as well as prevent outages that could result from overloading, Siemens said in a statement.

The substations and control centres are expected to be equipped with the new technology and go into operation by mid-2018.

Europe

UK tenders for offshore links

UK energy regulator Ofgem has invited companies to submit bids to own and run power links to two offshore wind farms.

The two links – Galloper wind farm off the east coast of England, and the Walney Extension wind farm in the Irish Sea – represent the second stage of the fifth tender round (TR5) for offshore transmission owners (OFTOs). TR5 is the largest tender round to date, with over 2.3 GW of generation and an estimated value of £2 billion ($2.56 billion).

Ofgem will choose the most competitive bids from companies to own and run links to the offshore sites over a 20-year period.

Ofgem will publish bidder shortlists for each project in the summer.

Amec FW to supply Finnish biomass boiler

Amec Foster Wheeler is to deliver a 158 MW steam generator for the Kymijarvi III biofuelled heating plant in Lahti, Finland.

The company has been contracted by Lahti Energia Oy to design and supply the thermal circulating fluidised bed (CFB) generator with auxiliary equipment. The deal also includes assembly and commissioning.

The boiler will burn biomass fuel comprised mainly of wood chips from forest residues and forest industry byproducts, and will be also able to use peat and coal as additional or alternative fuels.

Capstone expands in UK

Capstone Turbine Corporation has received an order for thirty C65 ICHP microturbines for a series of integrated combined heat and power (CHP) projects in the UK.

Pure World Energy, Capstone's UK partner, secured the order, which is expected to be commissioned beginning July 2017.

"Energy costs in the UK continue to rise, and facility operators are reviewing their energy strategies to see where savings can be made," said Simon Wright, Pure World Energy's Chief Executive Officer. "Our investment in purchasing an additional 30 C65 ICHP microturbines will enable us to fulfill the immediate demand we have throughout 2017 and expand our existing Capstone fleet."

The natural gas fuelled 65 kW ICHP microturbines will be installed at multiple leisure, healthcare and hospitality facilities.

Prysmian to develop IFA2 link

A joint venture of RTE and National Grid has awarded Prysmian a contract to develop the IFA2 link, an interconnector between France and the UK.

Under the €350 million contract, Prysmian will undertake the turnkey design, manufacture and installation of a submarine and land power cable link to connect Tourbe in France to Chilling in Hampshire, UK.

The high voltage direct current (HVDC) interconnection will operate at ±320 kV DC and will allow up to 1000 MW of power to be transferred between the countries. The HVDC cable system comprises approximately 25 km route length in France, running from Tourbe converter station in northern France to the landing point close to Caen.

The subsea route is just over 200 km and will land at the south coast of the UK at Solent Airport near Fareham where the UK converter station is to be located. In addition to the HVDC cable link, the contract includes a high voltage alternating current (HVAC) link that will connect the converter station to a local substation in Chilling, UK. This includes 2 km land sections at each end with a 5 km subsea section between them.

Siemens delivers battery storage

Siemens has received an order from Stadtwerke Schwäbisch Hall GmbH, a public utility company, to deliver a turnkey battery storage system.

The Siestorage system will have an output of 1 MW at a capacity of more than 1.4 MWh. Siemens will deliver the complete solution in a container ready to be connected and will also install it.

Stadtwerke Schwäbisch Hall will utilise the solution based on lithium-ion batteries for marketing primary control reserves. The system is expected to be connected to the grid and commence operation in the summer of 2017.

International

Siemens expands Kuwait plant

Siemens has received an order to deliver an industrial steam turbine package to expand the Az Zour South 3 open cycle gas turbine power plant to a combined cycle power plant.

Az Zour South 3 began operating as an open cycle power plant with two SGT4-5000F gas turbines in 2015. Siemens is now supplying an SST-800 steam turbine (high pressure) combined with an SST-500 steam turbine (low pressure) and an SGen1200A generator.

The project will increase the plant's total capacity by 263 MW without any additional gas consumption and will boost its efficiency significantly.

Saudi Arabia opts for mobile substations

National Grid SA, the transmission operator of Saudi Electricity Company, has awarded Siemens a contract to supply two mobile substations for its network operations.

According to Siemens, the two 380 kV mobile substations can fit in and suit any network area of the kingdom. With a rating of 502 MVA each, these two high-voltage mobile substations will be the most powerful ever built in a single feeder configuration.

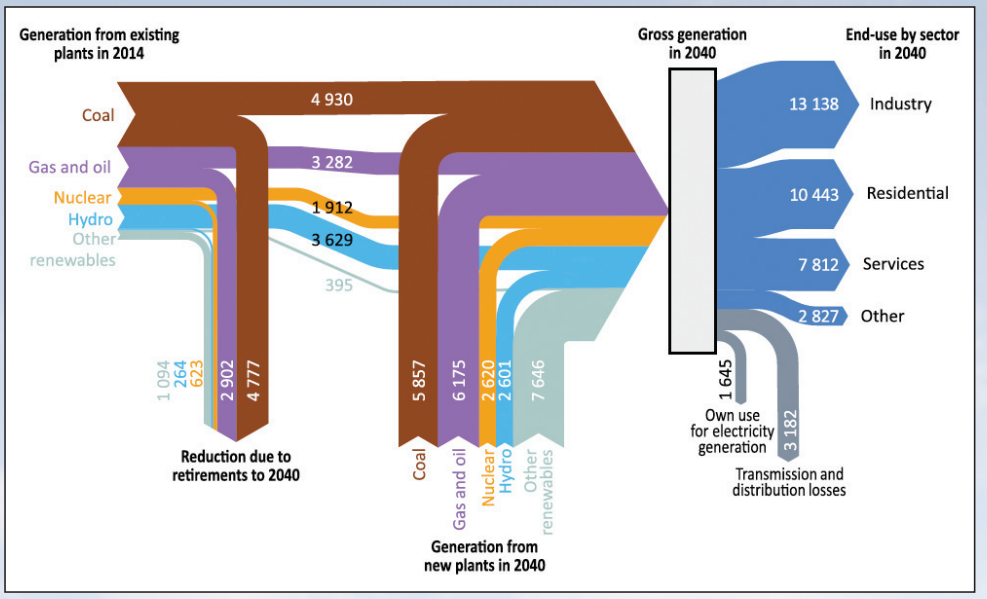
Mobile substations are a fast and versatile solution for emergency power restoration or fast-track grid connection that also guarantees the utmost reliability. They also support heavy maintenance or renovation work as an interim bypass substation that can be easily set up to reduce or eliminate power outages.

Kahramaa places L&T order

Engineering conglomerate Larsen & Toubro's construction arm has announced it has secured its single biggest order.

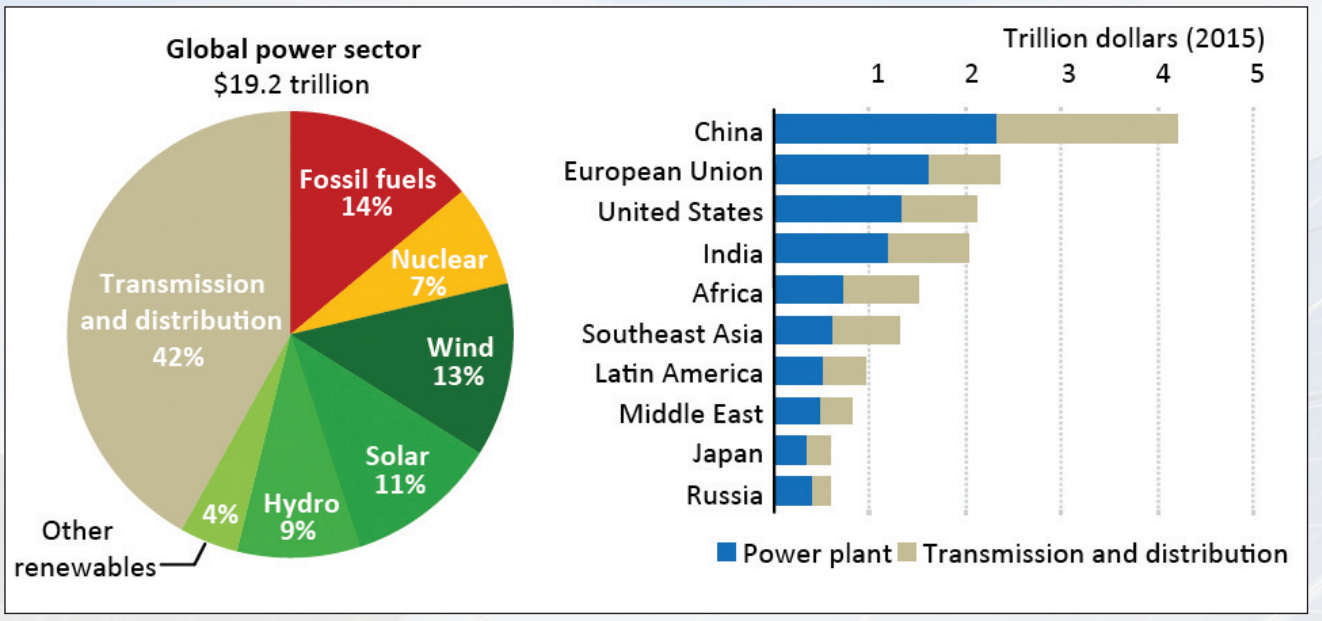
The company has received an order worth 5250 crore ($972.2 million) from Qatar General Electricity and Water Corporation (Kahramaa) for power transmission and network expansion. The contract involves engineering, procurementand construction of 30 new gas insulated substations as well as cables.

Global generation by fuel and demand by sector in the New Policies Scenario (TWh)



World Energy Outlook 2016, © IEA/OECD, Figure 6.11, page 262

Cumulative power sector investment in the New Policies Scenario, 2016-2040



World Energy Outlook 2016, © IEA/OECD, Figure 6.12, page 263

Cumulative investment in the power sector in the New Policies Scenario, 2016-2040 ($2015)

	2016-2025						2026-2040						2016-2040
	Fossil fuels	Nuclear	Renewables	Total Plant	T&D	Total	Fossil fuels	Nuclear	Renewables	Total Plant	T&D	Total	Total
OECD	**285**	**222**	**1 115**	**1 622**	**976**	**2 597**	**401**	**403**	**1 728**	**2 532**	**1 389**	**3 922**	**6 519**
Americas	115	91	468	674	410	1 084	191	153	661	1 005	619	1 624	2 709
United States	87	75	368	531	330	861	145	139	511	795	465	1 260	2 121
Europe	97	64	484	645	373	1 018	139	187	815	1 142	489	1 630	2 649
Asia Oceania	72	67	163	302	192	494	71	62	252	386	282	667	1 162
Japan	37	15	99	150	95	246	25	22	140	187	148	335	580
Non-OECD	**863**	**307**	**1 429**	**2 599**	**2 014**	**4 612**	**1 135**	**485**	**2 806**	**4 426**	**3 681**	**8 106**	**12 719**
E. Europe/Eurasia	173	76	39	287	171	458	154	136	149	439	266	705	1 164
Russia	82	61	16	159	65	223	76	84	78	237	111	348	571
Asia	500	202	1 068	1 769	1 387	3 157	659	273	1 850	2 783	2 310	5 093	8 250
China	200	159	666	1 025	797	1 822	130	182	997	1 309	1 078	2 388	4 209
India	149	29	225	403	291	694	268	67	445	779	566	1 345	2 040
Southeast Asia	103	2	90	196	221	417	179	16	222	416	482	898	1 314
Middle East	85	21	47	153	95	249	113	32	206	352	218	570	818
Africa	80	-	122	202	202	404	159	27	334	520	598	1 118	1 522
Latin America	25	9	154	187	158	345	50	16	266	332	288	620	965
Brazil	6	5	88	99	83	181	7	11	130	149	158	307	488
World	**1 148**	**529**	**2 544**	**4 220**	**2 989**	**7 210**	**1 536**	**888**	**4 534**	**6 958**	**5 070**	**12 028**	**19 238**
European Union	86	59	410	554	325	879	116	187	764	1 067	407	1 474	2 353

Note: T&D = transmission and distribution.

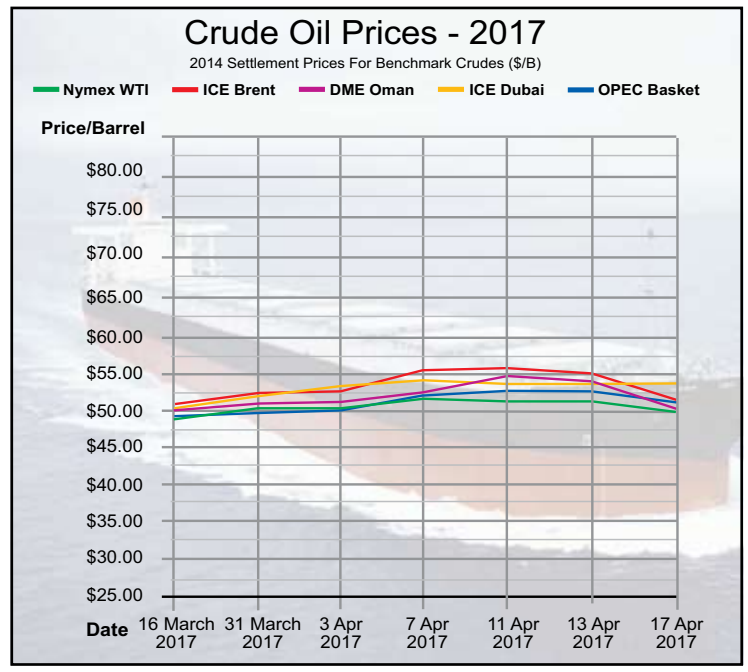
World Energy Outlook 2016, © IEA/OECD, Table 6.5, page 264

Source: World Energy Outlook 2016

Oil

Opec weighs question of continued production cut

- No decision on extension for production cutback
- Opec satisfied with the compliance statistics



David Gregory

Opec and its non-Opec partners in a plan to reduce global crude supply may opt to extend a cutback in crude oil production beyond June, Saudi Energy Minister Khalid al-Falih said last month during an energy conference in Dubai.

Despite worthy compliance with their reduction commitments, three months into the six-month timeframe has not quite made the impact that oil producers have been looking for. "Although there is a high-level of commitment, we haven't reached our goal, which is to reach the five-year average [of crude stocks]," Falih was quoted by Bloomberg as saying. "There is an initial agreement that we might be obligated to extend to get to our target," he said.

There is no decision on an extension for the production cutback, which has made some impact on the market but not as much as needed. Crude supplies are plentiful and demand is not as strong as producers would like – nor are prices – therefore the subject tops the agenda as the organisation heads towards its next ministerial meeting in Vienna, scheduled for May 25.

Media reports said Opec would meet with non-Opec representatives on the same day to determine whether a continuation of the 1.8 million b/d output reduction has indeed moved the oil market towards balance and whether extending the cut is necessary. Many observers in the oil market think so.

This decision will be taken after a careful assessment of market conditions and projections, Opec officials have stated in the media, but as the market remains oversupplied, the argument for an extended cut is solid.

Opec members, with the exception of Iran, Libya and Nigeria, agreed to cut production by 1.2 million b/d from October 2016 levels last November and 11 non-Opec producers, led by Russia, promised to cooperate with Opec and cut output by 558 000 b/d with the intention of bringing the oil market back into balance and restore prices to a range that producers can keep their budgets on track and give incentive to new investment.

In mid-April, the price of Brent crude and West Texas Intermediate were in the mid-$50/b range and volatile, reacting to daily events and also to stock movements in the US and while ample crude stocks remain in Europe.

A key issue facing Opec and other producers is the increasing presence of US oil and particularly shale oil, which has made a significant comeback since the production cut came into effect at the start of the year.

In its April report, the US Energy Information Administration (EIA) put US oil output at 9.1 million b/d during March, its highest level in a year. It forecast production to grow by an average of 0.3 million b/d in 2017 and by 0.7 million b/d in 2018. US crude output averaged 8.9 million b/d in 2016, but the EIA forecast the 2017 average at 9.2 million in 2017 and 9.9 million b/d in 2018. The agency said that oil from shale and unconventional plays would rise by 124 000 b/d in May and average 5.193 million b/d for the month.

While the production cutback and rise in prices has provided encouragement to the North American producers, Opec officials have expressed concern about prices rising to a level that will provide incentives for new investment in new projects that will ensure adequate oil supply once the glut is gone from the market. The officials have commented on this aspect of the future oil market for some, cautioning that a lack of investment now could result in a new round of oil shortages later, likely in the 2020s.

Meanwhile, Opec is reported to be satisfied with the compliance statistics available from those non-Opec producers participating in the cut, although Russia has yet to meet its commitment to a 300 000 b/d reduction. Reports show that it remains about 60 000 b/d short of its target of 10.947 million b/d. Russia produced 11.23 million b/d in October last year, the marker for the production cutback.

The Paris-based International Energy Agency (IEA) said in its April *Oil Market Report* compliance with the cutback quotas has been impressive for Opec countries and that non-Opec producers have increased their compliance rate steadily during the first three months of the plan. If the cutback should be extended by a further six months it would mean bigger draws upon stocks and further support for prices, but, it notes, this would provide further encouragement to the US shale oil sector and other non-Opec producers.

Gas

Bigger role for US gas at home and abroad

Natural gas is gaining ground in the US domestic market and promises to make a significant impact on the global market as LNG exports advance.

Mark Goetz

The US Energy Information Administration (EIA) last month released a statement saying that natural gas would be the largest source of power generation in the US during the summer of 2017. The percentage of generation will be lower than last summer, the agency said, but it will continue to exceed that of any other fuel, including coal fired generation, for the third summer in a row.

The EIA projects natural gas' share of power generation at 34 per cent during the months of June, July and August, down from 37 per cent in 2016, but still above coal's share of 32 per cent. Natural gas first overtook coal as the primary electricity fuel on a monthly basis in April 2015 and on an annual basis in 2016.

EIA data shows that the Midwest region is the only area of the US where coal is used as the primary fuel for power generation – 54 per cent, whereas in the northeast and south, natural gas accounts for 44 per cent and 43 per cent respectively for summer power generation.

The use of natural gas by power generators depends on its price, which accounts for a slight decline in its usage for 2017. During the first quarter of 2017, gas sold at an average of $3.01/million Btu at the Henry Hub terminal. A year ago, the average price for that time period was $2.00/million Btu.

That change in price caused gas usage for national electricity generation to fall from 32 per cent during the first quarter of 2016 to 29 per cent for the first quarter of this year. That meant an increase in the use of coal from 29 per cent to 31 per cent for those respective quarters. The EIA is predicting that the Henry Hub gas price will remain at around $3.00/million Btu through the summer.

Meanwhile, US natural gas exported in the form of LNG is increasingly seen as having an impact on the global gas market, which is moving away from its traditional link to oil prices because of its growing supply.

The US is expected to be a major exporter of natural gas in the 2020s and some analysts predict that it could become the main exporter by 2035, outranking Qatar and Australia, both of which plan to expand their current capacities. Russia is also working to establish its LNG sector and has its eyes set on China as a key market.

The LNG market has seen a number of changes in recent years. As supply has grown and oil prices have tumbled, the price of LNG has gone from $20.00/million Btu in early 2014 to around $6.00/million Btu at current spot market prices.

The oversupply of LNG has forced the traditional method of market operation to change. Buyers are now demanding shorter contracts, more availability on the spot market, and the right to resell cargoes. The traditional practice of long-term contracts linked to the price of oil is no longer in favour with buyers, who are now demanding better deals – something closer to five years at a price of around $8.00/million Btu.

Current global production is 340 million tons annually and hundreds of millions of tons have been proposed to come on-stream in the future, but there are doubts the market will be able to accommodate it.

Future US production is expected to move ahead rapidly. The export terminal at Sabine Pass, Louisiana, operated by Cheniere Energy recently marked the export of its 100th cargo after opening in early 2016. The terminal has three of its six planned LNG trains complete. Each has a design capacity of 4.5 million tons and total capacity will amount to 27 million tons per year when complete.

Several US LNG terminals are due to come into operation before the end of the decade. Dominion's Cove Point LNG terminal in Maryland will be on-stream later this year with a capacity of 5.25 million tons per year.

Dominion has already signed 20-year agreements to export the LNG to Japan and India, two of the world's growing gas markets. US LNG is also expected to be competitive in Europe, which is looking to diversify its sources of supply.

Energy storage post-Brexit: how will it fare?

Potential delays, power shortages and investment challenges arising from the UK's combination of nuclear policy, the capacity mechanism, the Renewables Obligation scheme and the Contract-for-Difference (CfD) clearly demonstrate a need for new technologies like storage. Collaboration will be key to unlocking its full potential.

Lis Blunsdon and **Edward Humphries**

Nearly a year on from the referendum, it is still difficult to assert with any confidence what direction the UK's energy sector will take post-Brexit.

One thing we do know is that when the UK leaves the European Union, it will also leave the European Atomic Energy Community. This will pave the way for complicated bilateral negotiations with other nuclear powers, and leave the UK's newly re-awakened nuclear generation industry in uncharted territory. At best, we can expect some delays in the deployment of new nuclear plants.

Another "known" is that the government's capacity mechanism is failing to produce high enough prices to ensure investment in new build gas fired plants. This leaves us with an ageing thermal fleet of generating assets with very few replacement options on the horizon.

We also know that as of 31 March this year, the Renewables Obligation scheme (which has supported the development of renewables projects in the UK for the last 20 or so years) will, bar a few very limited exceptions, close to new applicants.

Meanwhile, the mechanism that replaces the Renewables Obligation scheme – the Feed-in-Tariff Contract for Difference (CfD) – is far from as prolific as was originally hoped. The plan was for an annual allocation round; however, the first one took place in 2014, and we are only just now seeing the start of the second. If the rumours are to be believed, the second round may also be the last.

The government's energy policy over the last decade or so has focused on the "trilemma", namely how to balance security of energy supply, energy affordability and decarbonisation. In its recent green paper 'Building our Industrial Strategy: Green Paper, January 2017' (the Strategy Green Paper), the government stated:

"On Climate Change, the settled policy position is reflected in the government's commitment to meeting its legally-binding targets under the Climate Change Act. How we will continue to meet our legal obligations will be set out, as required, in the forthcoming Emissions Reduction Plan. […] This means that in the years ahead, two important areas of energy policy require a higher priority: the affordability of energy for households and businesses, and securing the industrial opportunities for the UK economy of energy innovation."

Blunsdon: energy storage is definitely on the government radar

Is this an indication that de-carbonisation is taking a step into the shadows while affordability and innovation step into the limelight? There has been much furious Tweeting from the government to the effect that its commitment to carbon reduction remains strong and centre stage. However, renewables subsidies have been reduced significantly, and the sector is acclimatising to a brave new world without them. With a shift of priorities and a largely subsidy-free renewables sector, does a focus on innovation mean that there is now a new sense of direction in the energy sector?

One area where there has been significant interest is the development of energy storage – particularly batteries. Ironically, one of the driving forces behind the stellar development of energy storage in California (currently the storage sector's poster child) is the practical issue posed by the increasing deployment of intermittent renewables.

Intermittent generation can present problems to grid operators who are trying to balance the overall system at the least cost. Ideally, there should be back-up generation available at all times to cover sudden drops in wind and solar output. However, keeping large-scale thermal assets that were designed to run as base load ticking over on the off chance that the weather deviates from the forecast is neither economical, nor very helpful in limiting carbon emissions.

Energy storage can help to smooth out these fluctuations, and can also be used to provide very fast (sub-one second) frequency response services. National Grid's recent Enhanced Frequency Response (EFR) tender resulted in the award of eight contracts to provide 201 MW of this type of capacity, all of which is coming from batteries.

The Strategy Green Paper identifies ten pillars on which industrial strategy is to sit, one of which is "delivering affordable energy and clean growth". Moving the energy portfolio out of DECC and into the newly created Department for Business, Energy and Industrial Strategy (BEIS) is described as being part of this process. An Industrial Strategy Challenge Fund will also be established, in part to explore the development of smart, clean energy technologies such as storage and demand response.

At the same time, the government has appointed Sir Mark Walport, the recently appointed Chief Executive of UK Research and Innovation (UKRI), to conduct a review as to whether there should be a new research institution to act as a focal point for work on battery technology, energy storage and grid technology. His findings are due in 2017.

The Second Allocation Round for CfDs has a new set of terms and conditions that refer to energy storage facilities (a definition that is not limited to batteries). The consultation that preceded this addition was couched in terms of allowing energy storage to take part in the CfD process.

The drafting that has actually been published switches the position around. It provides that generators may not include a storage facility in a CfD project unless the facility has a separate Balancing Mechanism Unit associated with it and it is only charged using electricity from the facility that is the subject of the CfD. This makes sense from a subsidy point of view, as it means that only renewable energy is being stored (the facility has to be a qualifying renewable generator to be eligible for a CfD in the first place). It does however restrict the deployment of energy storage that qualifies for a CfD to co-located facilities, and does not provide support for storage per se.

So, energy storage is definitely on the government's radar, but is that enough to enable it to fulfil its potential? It's certainly a start, but the constant refrain from the industry over the past few years has been that the government needs to deal with the regulatory aspects of storage projects in the UK if large-scale deployment is to become a reality. Storage doesn't need government subsidies in order to develop, but it does need a clear, straightforward regulatory framework and sufficient comfort that storage will be part of the government's energy strategy in the future.

Part of the problem is that in the UK there is no clear classification of what storage is. Historically, to the extent that it has been categorised at all, it has been seen as generation, but storage does not fit well into the definition of generation under the Electricity Act. While it has some features that are similar to generation it has many others that are not.

Storage can perform multiple physical and commercial functions and part of the problem is how to capture the benefit of this versatility. Commentators talk of "stacking" benefits – by which they mean being able to provide, for example, ancillary services, arbitrage power prices, network support and demand side reduction, all using the same kit (although not all at the same time!). There is no other technology currently in use on our electric system that has these characteristics and it seems logical that there should therefore be a separate licensed asset class to cover storage.

The contractual framework that allows for full commercial exploitation of storage assets is not yet fully defined. Contracts for the provision of services to National Grid can be an important revenue stream for generators, but there are currently restrictions in some of these contracts that means providing multiple services from a single asset can be difficult.

It was encouraging to see that storage projects were successful in the 2020/21 capacity auction, with 3.2 GW gaining 15-year capacity contracts. However, not all storage technologies meet the technical parameters under the current capacity mechanism (designed for generators, not storage) even though they could provide useful capacity at times of system stress.

Humphries: storage will not reach its full potential as long as it lacks a classification of its own

The structure of the electricity market can also be a challenge. In recent years we have seen the unbundling of functions within the electricity industry, driven largely by competition concerns. This has meant that certain assets – most notably generating assets – cannot be held by distribution network operators (DNOs). For as long as storage lacks a classification of its own, it will not reach its full potential. Storage can be of great benefit to distribution network operators in balancing local fluctuations on the distribution system, often caused by intermittent generation, but cannot currently be owned by DNOs (subject to a *de minimis* threshold).

The potential delays, power shortages and investment challenges arising from this combination of nuclear policy, the capacity mechanism, the Renewables Obligation scheme and the CfD clearly demonstrate a need for new technologies like storage. Collaboration will be key to unlocking its full potential.

There have already been various government funded demonstration projects involving DNOs, universities and energy suppliers. The results of these test projects have been freely published and provide valuable, and sometimes surprising, insights into how best to collaborate and commercialise storage. Having the government behind further innovation as evidenced by the Strategy Green Paper, both in policy terms and in providing additional funding, can only be a good thing.

Lis Blunsdon, of counsel, and Edward Humphries, partner in the energy and infrastructure practice at international law firm Orrick.

Smart moves

Europe and North America are the most advanced adopters of smart grid and smart metering technology, although the market is now shifting towards Asia and the developing world. But while future opportunities exist, the Global Smart Grid Federation believes these will be difficult to realise.
Ronnie Belmans

There is no doubt that we are in the midst of an energy revolution. Not only is the nature of energy changing from fossil-generated energy to renewable, there is a total change in the distribution structure occurring with less focus on centralisation, economy of scale, and more on distributed energy economy of scope by harvesting local resources.

By making the electricity grid 'intelligent' and adding telecoms to it, the power will eventually shift away from the electricity companies and to the customers, who will be able to control their energy consumption through sensors, machine-to-machine (M2M) devices, and the Internet of Things (IoT).

Europe and North America are rated as the most advanced adopters of smart grid and smart metering technology, but the market is now shifting more and more towards Asia and the developing world.

'Smart' means communication, and since many countries are addressing their broadband networks, the smart thing to do would be to roll out fast broadband infrastructure in combination with smart grids and, wherever applicable, other smart infrastructure. In that way, energy efficiency measures can be implemented throughout society and throughout the economy (buildings, transport, cities) with a minimum of extra infrastructure, as a trans-sector approach is based on sharing the infrastructure.

From many different directions – political, environmental and economical – the industry is under pressure and it has no choice but to change. This, of course, is far more easily said than done. Unlike the telecoms industry, which faced significant changes a few decades ago, there is no new product on its way for the electricity companies to tap into. The telcos developed mobile, broadband and ICT services, but it is much harder for the utilities to come up with replacement services.

While one obvious direction is to develop new businesses around renewable energy, micro-grids, smart street lights, EV, etc., the problem will be that once such models become successful the question will arise as to whether they should be delivered through the monopoly model of the utilities or through the market. We already see in some of the European countries that the regulator has stepped in on the request of other market parties and ruled that, for example, the operation of EV loading stations should be left to the market.

Prof. Dr. Belmans: Disruption is happening and the challenge for the industry is to run with it

Both the social and economic benefits will be significant as these new businesses will add new jobs, will save consumers money (energy efficiency), will be environmentally friendly and will be far more sustainable long-term. This future energy model will also be a key driver for much broader innovation and will be a key infrastructure element for the emerging smart cities.

A number of examples illustrate some of the developments in a global playing field.

France: Since 2008 and till 2014, the development of smart grids in France has given rise to 121 experimental projects (demonstrators and associated R&D), each oriented to a specific technology/issue of smart grids: €508 million has been invested, which is why France is the leading country in the European Union in terms of R&D. A number of key topics could be identified: network management 29 per cent, smart homes 24 per cent and integration of renewables 21 per cent.

Since 2016, France has been deploying smart grids on a large scale in three regions: in the southeast (Flexgrid project), in the west (Smile) and in the north (You&Grid). "Linky" smart meters have been progressively installed since 2010 and by 2021 will replace 35 million traditional meters.

Turkey: In the Turkish electricity sector, a transformation of the electricity distribution network infrastructure has started along with major changes like privatisation, unbundling of distribution companies and supply/retail companies and a liberalisation of the market completed in 2013. Twenty-one electricity distribution companies started this transformation on different levels, with modernisation of grid elements as well as using information and communication technologies in grid operations with high investments.

Currently, consumers use three types of meters: smart; electronic; and mechanical meters totaling about 38 million. Meters installed since 2013 are now owned by the DSO; previously they were consumer owned.

Following a decade of transformation, Turkey is getting ready to pass another major milestone with the Turkey Smart Grid 2023 project (TAS2023).

Within the scope of the project – under areas such as smart grid management, smart embedded systems, smart customers and tariffs with smart system integration – many smart network technical domains like renewable energy integration, smart meters, demand side management, advanced network management systems (SCADA/DMS/OMS etc.) are found. Geographical information systems (GIS), IT systems and integration, cyber security, storage systems, electric vehicles, communication technologies are studied as well.

South Korea: Since the development of power and IT convergence technology in 2004, South Korea has been promoting related industries for around 10 years. These efforts were recognised when it was designated as a leading country in smart grid technology by the UN's MEF (Major Economies Forum on Energy and Climate) in 2009.

Initially, the government divided the smart grid industry into five sectors based on large-scale businesses – smart consumer, smart transportation, smart renewable, smart electricity service and smart power grid. Visions and roadmaps were developed in three stages: first, build a smart grid test-bed city by 2012; second, deploy smart grids for wide areas by 2020; and ultimately, establish a nationwide smart grid by 2030.

Based on the first stage of this national roadmap, Jeju Island, the biggest island in South Korea, was selected as a smart grid test-bed. Many kinds of demonstration projects involving various technologies had been tested for the purpose of R&D and commercialisation on the island until 2013. In 2014, a demand-side resources (DR) market opened to promote DR in smart grids. In addition, the government developed and provided National Competency Standards (NCS) for company workers to quickly adapt to and lead the smart grid industry.

From 2015, the focus of Korean smart grid industry moved to market expansion and policy development based on selection and concentration of the following three areas: an energy solution converged with electricity, power and ICT; distributed and micro grids; and unit-level businesses.

Along with these domestic changes, Korea is also keeping up with global trends as it has carried out the second stage of the national roadmap to "deploy smart grids for wide areas by 2020." To this end, the Smart Pilot Towns Project was launched in 2016 and eight consortiums (Kepco, KT, Posco ICT, LSIS, SKT, Hyundai AutoEver, GIMCO, SuwanEnergy) are proceeding in 15 cities.

India: Today India is pursuing some of the largest transformation projects in history such as building 100 smart cities, adding 175 GW of renewable energy and adding 6-7 million electrical vehicles by 2022. Last year India added 12.5 GW of renewable energy resources against 10.3 GW of conventional generation resources. This trend towards renewables will require smarter systems on the grid.

In its journey towards smart grids, the Government of India issued a Smart Grid Vision and Roadmap in August 2013 and also launched a National Smart Grid Mission (NSGM), which will coordinate the implementation of smart grid projects in all the states.

India is also executing a few smart grid pilot projects in different states, and five or six of these are expected to be completed in early 2017.

The Bureau of Indian Standards (BIS) issued national standards for smart meters in 2015. In the tariff policy approved by Government of India in January 2016, it is envisaged to bring all customers with monthly consumption of 200 kWh and above under smart metering by December 2019. Accordingly, the Central Electricity Authority (CEA) issued detailed technical specifications and rollout strategies for smart metering in August 2016. It is expected that smart metering projects with millions of smart meters will be announced in 2017.

While these countries demonstrate that new opportunities exist for electricity companies, the reality is that they are difficult to realise. There are several reasons for this.

In most countries, either directly through ownership or indirectly through regulations, governments have a dominant influence on the sector. A lack of political vision and leadership and an inability of regulators to step in are a serious hindrance to settling on the direction of the industry.

At the same time – based on industry practices and the very long-term investment cycles that have dominated the sector for decades – the industry is risk-averse and led by management that in most cases is unable to seize the new opportunities that are becoming available within an increasingly disruptive environment.

Furthermore, the transition from the old silo-based energy economy to the new open-ended, interconnected one is very complex, and this transition will be messy.

Most governments and incumbent industry players around the world are grappling with these issues. Where we do see leadership and innovation is in places where cities are still operating their own electricity networks.

As a consequence of all of the above, changes will happen. It is hard to predict exactly how it will work out, but there are several trends and developments under way that will have a profound impact on the shaping of the industry. These include:

- Disruptive (often unexpected) developments from companies and their customers operating in the digital/sharing/networking economy outside of the industry
- In cases where there is a continual lack of national political leadership, the electricity sector will be forced to step up its role in new developments.
- Smart energy developments will increasingly be community/city-driven, with developments such as micro-grids, community storage, solar and wind farms, (smart/wi-fi-driven), LED street lighting.

Disruption is happening and the challenge for the industry is to run with it. However, in some cases it is hard for the industry to take a leadership role because of current government policies, regulations and its own out-dated business models. So changes, innovation, new business models and new value-added business opportunities will arrive from outside the industry. Some of the electricity companies will be able to break through this and participate and thrive in the new digital sharing and networking economy.

Prof. Dr. Ronnie Belmans is Executive Director of GSGF (Global Smart Grid Federation).

Getting the drop on coal

A new type of black pellet looks set to offer generators a true 'drop-in' biomass replacement for coal. **Junior Isles** reports.

CoalSwitch is a 'black pellet' that can be ground into a very fine powder, capable of being used by coal handling systems and does not have the corrosive elements contained in biomass

In an effort to cut emissions, many coal fired plant operators are converting their plants to allow firing on biomass. The cost of conversion, however, can be substantial. And even for those that have made or are considering the conversion, there are often questions around the sustainability of the biomass used to replace the coal. But a solution may be on the way.

UK-based company, Active Energy Group (AEG) is currently in the process of commercialising a revolutionary 'drop-in' biomass product which produces pellets only from waste timber (unlike the white pellets currently used), thereby ensuring that the whole tree is used during forestry operations rather than pieces of it being left to rot. According to AEG, its pioneering product, CoalSwitch, can be mixed at any ratio with coal, or completely replace coal in existing coal fired power stations globally without the need for retrofitting.

The new fuel is certainly good news for coal fired generators, not just in terms of environment but also from an economic standpoint. The cost of converting three of the six coal fired boilers at the UK's Drax power station for full firing on biomass has been well documented. The price tag for modifying fuel mills and boilers at the plant and the construction of storage facilities and conveyors for the wood pellets is estimated at around £700 million.

It is a huge investment, which AEG believes could largely be avoided through a fuel like CoalSwitch.

Brian Evans-Jones, Chief Financial Officer, Active Energy Group, argued: "In our view, the cost of the Drax conversion is rather scandalous. The UK government sort of nailed its covers to the biomass mast and Drax went off down that route. We had discussions with government almost two years ago and the opinion of the advisers to Westminster was that we were behind the curve on this and that white pellet was the future. I was staggered then, and remain absolutely staggered now.

"The carbon footprint of that process is well documented and it is not the way forward in our opinion. What we are looking to do is use waste product or timber that has no decent commercial value."

CoalSwitch is based on a technology that had been under development in Utah, USA, for several years.

Evans-Jones said: "The technology was brought to us in late 2015. We had a look at it and formed a joint venture to actually move it forward. This culminated in us bringing the whole business in-house through a share-swap last year so that CoalSwitch technology is now part of the group."

AEG says its emphasis has been on avoiding what has been happening in the white pellet market, where hardwood and very high quality wood is used to produce high calorific value biomass pellets. CoalSwitch is a "second generation" biomass that is produced entirely from waste material instead of cutting down trees.

CoalSwitch is essentially a 'black pellet' but with some key differences, according to AEG. It can be ground into a very fine powder, capable of being used by coal handling systems in power plants and does not have the corrosive elements contained in biomass.

"Once you get over 5-6 per cent of firing biomass in a coal fired plant, you start to experience issues," said Evans-Jones. "Our process removes the salts – the chlorine, potassium, etc. Other black pellet production processes don't actually remove any of the impurities that cause it to be a problem when it is burned in coal fired power systems. Our entire approach has been to focus on removal of impurities in biomass, thereby elevating the calorific value and allowing it to be fired in coal plants without affecting the boiler."

Testing of the pellets has been carried out as the fuel has evolved. Just over a year ago, AEG engaged with the University of Utah to run some tests at its highly accredited research facility. The test, led by Dr Andrew Fry, was on the original fuel developed at Utah University.

Since then the fuel has been substantially improved, according to Evans-Jones. "We have invested a lot of money in the pilot plant in the interim. The goal is to increase the calorific value to between 9800 and 10 200 Btu/lb (22.8-23.3 MJ/kg)." This is the range that will allow a generator to maintain base load."

Commenting on this test, he said: "Not only have they burnt it, they have burnt it with coal. They have proved that we have taken the biomass material and raised it to a calorific value that is comparable with many coals." In the co-firing element of the test, Evans-Jones notes that researchers also discovered that the pellets improved the efficiency of the burning of the coal.

Following this test, the University performed another set of tests commissioned by Rocky Mountain Power. The utility, based in Salt Lake City, has 1.1 million customers and is looking to move into the biomass space to improve the environmental performance and sustainability of its generating fleet. It therefore, wanted to see if CoalSwitch burns like coal and whether it is truly a "drop-in" alternative to coal.

Evans-Jones commented: "We believe this is the first drop-in alternative to coal because it can be pulverised down to powder for pulverised coal injection. This is done in a bore mill, and Rocky Mountain Power wanted to test to ensure there were no flashover issues or risk of fire."

The tests showed its handling characteristics were more or less identical to coal, with no issues identified during the bore mill test. Satisfied with the results, Evans-Jones says Rocky Mountain Power is now awaiting a 500 t sample and is one of 17 major power producers now looking for samples.

AEG is currently able to produce about 1 t/day of CoalSwitch and is therefore raising capital to allow it to expand production capacity to the level needed by generators.

"The biggest sample a utility has asked for to-date is 50 000 t to do a burn test, so it will take a while to produce this. I recently put together a fundraiser with the aim of getting the first commercial plant operating. The intention is to have that first reference plant operating before the end of this year."

AEG says it is in advanced negotiations with "a substantial partner" on the first commercial reference plant but has a number of alternatives for that, both in North America and Southeast Asia.

With a commercial scale installation imminent, Evans-Jones is confident of the future outlook. "We have an endless stream of people looking to engage with us on the CoalSwitch technology. If we had a plant operating at the right level, I could sell on commercial terms a quarter of a million tons of pellets tomorrow to some of the world's major power generators."

Improving black pellet production

As the biomass industry comes under closer scrutiny with regards to the sustainability of the resources used to produce the fuel, industry players have been developing technologies to produce black pellets. In addition to being sustainable, these are claimed to be safer, more cost-efficient, and deliver more energy than conventional "white" biomass pellets. This is becoming increasingly important in a market where demand is growing rapidly.

According to market consultants Hawkins Wright, total global biomass pellet demand is expected to nearly double in the next seven years, from 29 million tons in 2015 to 53 million tons in 2023.

Large amounts of renewable woody biomass feedstock are widely available across the globe at competitive prices. However, this biomass feedstock is often inefficient to transport to its final end-users, largely due to its high moisture content.

Valmet solves this problem through steam treatment of the woody biomass followed by rapid depressurisation. This process creates a low-moisture material that is suited for the production of durable, water-resistant pellets or briquettes. These black pellets can be transported safely and economically over long distances, allowing power generators to take advantage of the global abundance of raw biomass supply.

According to Valmet, its black pellets can replace fossil coal up to 100 per cent in smaller units and up to 70 per cent in larger units. The powder produced by grinding has a relatively high bulk density and is free flowing, meaning that it is ideal as a feed material to entrained flow gasification systems as well.

Valmet's technology partner Zilkha Biomass has already completed nine full-scale tests of the final black pellet product at utilities across Europe and Japan, in units ranging from 80 MW to 500 MW in size. In total, over 9000 tons of black pellets have been tested by potential utility customers.

Promises set in stone?

Junior Isles

For Christians around the world, Easter is often a time of reflection and remembering Jesus' promise of eternal life. As memories of Easter mingle with thoughts of what goes on in the mind of leaders, one wonders to what extent US President Donald Trump sees himself as the great deliverer.

As Trump reaches his first 100 days in office, industry observers have been assessing the energy and climate change policy implications of his actions, both for the US and globally.

Whether for good or ill, Trump's actions are certainly in line with his campaign promises – at least on energy. In the run-up to the election he promised to revive the flagging US coal industry as part of a new energy policy that attempts to roll back former President Barack Obama's Clean Power Plan (CPP).

President Trump campaigned on a pledge to bring jobs and production back to a sector that has been on a steady decline for over a decade. But although we live in a world of surprises, it is fairly safe to say that coal is probably beyond resurrection.

To restore the coal industry, Trump would have to revive demand for coal by electric utilities but there is little chance of that. Data from Energy Information Administration shows that in 2015 alone, utilities retired power plants generating 22.2 GW of electricity. Coal fired plants accounted for 67 per cent (14.8 GW) of the retirements.

Reuters recently surveyed 32 utilities with operations in the 26 states that sued Obama's administration to block the CPP. It revealed that the bulk of them have no plans to alter their multi-billion dollar, years-long shift away from coal, suggesting demand for the fuel will keep falling despite Trump's efforts.

For example, in early April the operators of the Navajo Generating Station, the largest coal fired power plant in the west, announced plans to close it by 2019. The electric utility Dayton Power & Light will shut two coal plants in southern Ohio by next year. Across the country, at least six other coal fired power plants have shut since November, and nearly 40 more are to close in the next four years.

American Electric Power (AEP), an Ohio-based utility that provides power to five million people in 11 states, recently noted that in 2005, 71 per cent of its electricity was coal fired but said that figure has dropped to 47 per cent. It projects that this figure is expected to fall further.

AEP noted natural gas fired power has grown to 27 per cent from 20 per cent in 2005, and that share is expected to grow. It also said over the next three years, the company plans to invest about $1 billion in new wind and solar generation.

In a recent online survey of 600 utilities in the US and Canada only 4 per cent of executives believe there will be a moderate or significant increase in coal use as part of their utility power mix within the next decade.

There are numerous reasons behind the trend: natural gas is cheap and abundant and solar and wind power costs are falling. Another reason is that state environmental laws remain in place; and Trump's regulatory rollback may not survive legal challenges. Trump has promised to lift environmental regulations that restrict fossil fuel use but while Executive Orders can set the direction of policy, they cannot undo regulation. This may be another promise he cannot deliver.

In the same way that Obama faced litigation when attempting to turn policy to law, so will Trump. Legal experts say it is not certain that Trump will succeed in efforts to roll back the CPP. And under the current statute, which has yet to be put into effect, the federal government is still required to regulate carbon dioxide emissions. So, even if Trump does succeed in repealing his predecessor's carbon dioxide rules, either he or his successor will be required to issue replacement rules.

The CPP, finalised in 2015, is the centrepiece of Obama's 2013 Climate Action Plan. Implementation of the rule was stayed by the Supreme Court in February 2016, pending resolution of legal challenges currently before the D.C. Circuit.

Looking beyond his borders, Trump also promised to "rip up" the Paris Agreement but interestingly he has not done so as yet.

Kevin Book, Managing Director at ClearView Energy Partners LLC – a Washington-based independent organisation providing research and analysis of macro energy trends – offered his take on the situation.

During a recent online media briefing hosted in London by the Energy and Climate Intelligence Unit (ECIU) he said: "Our current view is that the Trump administration will remain within the Paris Agreement, at least for the time being. When President Trump wants to leave a deal, President Trump leaves a deal. If they wanted to leave the deal, that process would already be under way. By staying in, Trump's administration retains something that pleases the internationalist wing of the Republican party. The opportunity to remain at the table is something the US feels it needs to preserve.

"It is also our contention that the Trump administration may be daring other parties to the agreement to cast the first stone."

Book's thinking is that, to some degree, by remaining at the table but failing to meet the compliance obligation, the Trump administration is forcing a conflict that might have occurred anyway within the contract of the agreement. While countries set emission goals under the agreement, as Book points out, the "uncomfortable question of what to do if anyone comes up short" still remains.

The current belief is that the US may well fall short of its UN emissions targets. It will certainly struggle to honour its Paris commitments under a Trump administration. These include cutting US greenhouse gas emissions by at least 26 per cent below 2005 levels by 2025, and giving billions of dollars in aid for poor countries trying to curb their own emissions and cope with climate impacts.

Bob Ward, policy director at the Grantham Research Institute on Climate Change and the Environment, in London, said Trump's actions "make it virtually impossible" for the US to fulfil its nationally determined contribution.

With the next stock-take on countries' progress in 2018 and the next stage of emission setting in 2020, it seems the reason for the Trump administration to leave the agreement imminently is not there.

Book noted: "The Paris Agreement is the framework that starts something in motion… and the US plays a leadership role. It also plays a signalling role in terms of whether there will be enforcement or not. Enforcement, however, was not the first concern; the first concern was participation – building the framework to get people in, not keep them out for failure to comply."

With regards to the Trump administration setting itself to renegotiate a global contract, one's leverage for renegotiation tends to be greater if one waits until there's some dispute about performance. There is a real expectation that the US, on its current trajectory, will miss its Paris pledge – and probably by a good margin. But it might not be the only country to do so and the Trump administration may find it's in its interest to stay and wait until the discussion of attainable ambition is framed by other countries' performance."

He also a notes that if the US is the only country that is on track to miss its ambition, another possibility is that it could force other countries to decide what they are going to do about it; this in itself will strain the framework. "This," said Book, "could have the *de facto* effect of scuppering the entire deal."

No doubt much will depend on the world we will be in when these scenarios start to play out. Joan McNaughton, Chair of The Climate Group and Executive Chair of the World Energy Council's World Energy Trilemma, was also on the expert panel. She commented: "If for example we have had more extreme weather and the signs become more hard edged, I'm not sure there will be that much playing of politics at that level. I think there will be a coalition of the willing to just press on."

Trump's approach may draw comparisons with the Christian gospel John chapter 8, verses 3-7. But where Jesus sought peace, Trump seems to be seeking division. Inviting others to cast the first stone may not have the desired outcome.

Cartoon: jemsoar.com