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Toshiba woes throw UK nuclear plan into doubt

Toshiba Chairman, Shigenori Shiga, stepped down after the company reported a \$6.3 billion writedown on its US business

Growing uncertainty surrounds the UK's plans for a new generation of nuclear plants as Toshiba pulls out of the construction of the Moorside project and the country prepares to leave Euratom following Brexit. **Junior Isles**

Financial problems at Japanese multinational conglomerate Toshiba look likely to heap further pressure on the United Kingdom's plans for a new generation of nuclear power plants.

Last month the company's Chairman, Shigenori Shiga, stepped down after Toshiba reported a \$6.3 billion writedown on its US nuclear business. The announcement has forced Toshiba to announce that it wants to sell its controlling stake in the NuGen consortium, which is planning to construct three reactors for the 3.8 GW Moorside nuclear plant in Cumbria. NuGen is now reportedly seeking

investment from state-owned Korea Electric Power Corporation (Kepeco) to keep Moorside afloat through a deal that would see Kepeco buy some or all of Toshiba's 60 per cent stake in NuGen.

The picture is further complicated by uncertainty over the future of Westinghouse, the Toshiba subsidiary at the heart of its financial problems. Toshiba bought Westinghouse for some ¥490 billion (\$4.36 billion) in 2006, on the back of strong global demand for nuclear power plants, which has since waned. Westinghouse is also currently constructing four nuclear

reactors in the United States, which are behind schedule and over-budget, and is building four more in China.

Toshiba is now exploring the possibility of selling the Westinghouse business, which is supplying three AP1000 reactors for Moorside. With the reactors currently going through regulatory approval, however, changing them could mean significant delays for the project.

Ministers, however, insist the project is still on track. Business and Energy Secretary Greg Clark said: "I have spoken to Toshiba and NuGen. I welcome the continued commitment

of the NuGen consortium to the Moorside project."

Toshiba's exit from Moorside will leave a significant hole in the \$15-20 billion funding needed for its construction. NuGen Chief Executive, Tom Samson said he was exploring "a universe of opportunities" to bring in additional investment.

Meanwhile, the government is being urged to once again extend guarantees and financial support to the project, as it has done for Hinkley Point C.

"Any potential investor in that

Continued on Page 2

EU 2030 climate and energy targets "too modest"

Climate Action Network (CAN) Europe, Europe's largest coalition working on climate and energy issues, says the EU's climate and energy targets are too modest.

The claim follows the release of the State of the Energy Union Report, which shows that the EU is well on track to meet its 2020 climate and energy targets, with the climate target in particular set to be largely overshoot.

Miguel Arias Cañete, EU Commissioner for Climate Action and Energy, said: "Europe is well on track to meet its 2020 climate and energy targets. Despite the current geopolitical uncertainties, Europe is forging ahead with the clean energy transition."

Based on 2014 data, the share of renewables reached 16 per cent of the EU's gross final energy consumption, and an estimated share of close to 16.4 per cent in 2015, according to the EC.

"Europe as a whole is performing

well in its deployment of renewables. In 2011, renewables generated 21.7 per cent of the EU's electricity; three years later, this figure has reached 27.5 per cent, and it is expected to climb to 50 per cent by 2030," the EC stated.

CAN Europe, however, argues that this indicates that the 2030 targets are also far too modest.

Wendel Trio, Director of CAN Europe commented: "Current progress does not mean that the EU can rest on its laurels, because it has set the bar extremely low. Being on track to reach our current weak targets gives one additional argument that the EU can and must do more to scale up climate ambition. Aligning the energy transition with the Paris Agreement will require more ambitious climate and energy targets, strong legislation, and additional measures such as deadlines for phasing out fossil fuels."

According to the EC report, the use

of renewables has allowed it to reduce its fossil fuel import bill by €16 billion.

Renewable energy made up nearly nine-tenths of new power added to Europe's electricity grids last year, in a sign of the region's rapid shift away from fossil fuels. However, industry leaders said they were worried about the lack of political support beyond 2020, when binding EU renewable energy targets end.

WindEurope said the European renewable energy industry and investors need clarity on volumes and regulatory frameworks in the years after 2020 to be able to continue investing. It warned that without the clearly set targets and regulations for the period after 2020, financing and deployment of new projects in Europe is likely to stall.

Giles Dickson, Chief Executive Officer of WindEurope, noted: "Today only 7 out of 28 have clear plans and

policies in place for renewables beyond 2020. Over half the Member States invested nothing in wind energy last year."

The European Parliament has voted to adopt a proposal to reform the EU Emissions Trading System (ETS) Directive for the post 2020 period, putting forward the Innovation Fund for clean energy projects. The vote provides a clear outcome after more than a year of discussions in Parliament. Commenting on the vote in the European Parliament, Kaspars Kemeklis, Policy Officer at Ocean Energy Europe, said: "The vote is a step in the right direction for funding the energy transition. The Parliament proposes to increase allocations to an Innovation Fund from 400 to 600 million allowances. This will allow renewable energy demonstration projects, like ocean energy farms, to get the extra financing needed to get into the water."

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project is going to need to have very direct reassurance from the government; even if they are just starting an exploratory period, they are welcomed," said Tim Yeo, chairman of pro-nuclear group New Nuclear Watch Europe, and a former Conservative MP. He added that ministers should even consider taking a direct stake in the Moorside plant.

Unions also called for the government to step in with funding to save the plant. General trade union GMB urged the government "to ensure everything possible is done" to ensure this project goes ahead and "fill any future gaps in funding".

NuGen is one of two Japanese-led developers expected to begin negotiations with government in the coming months over a 'strike price' for electricity from new UK nuclear plants. The other is Horizon, owned by Hitachi, which is planning to build two reactors at Wylfa in Anglesey, Wales.

Moorside is one of six projects the UK is hoping will be developed over the next decade or so. The government had originally planned to add 16 GW at the six sites by 2025 but this target has since slipped to 2030.

EDF, the developer of Hinkley



Hinkley C finally received the go-ahead last year

Point C, which will be the first of the projects to be built, had originally envisaged that the first of the two reactors would come on line in 2018. However, due to protracted negotiations over the guaranteed price of electricity from plant, the government only gave it the green light last year. This means start-up will likely be some time during the 2025-2029 time frame.

The looming problem at Moorside comes as the UK prepares to leave the European Atomic Energy Community (Euratom) due to the 'Brexit' decision. Euratom establishes a common market in nuclear goods, services, capital and people within Europe as well as arrangements for safeguards related to the Nuclear Non-Proliferation Treaty.

Experts warn that leaving Euratom would likely result in further delays to the UK's new nuclear programme. Dr Paul Dorfman of the Energy Institute at University College London told *the Guardian*: "Leaving Euratom is a lose-lose for everyone. For nuclear proponents, the industry becomes less competitive – and for nuclear critics, safety regulation diminishes."

Referring to Hinkley Point and other nuclear projects in the pipeline, he said: "The UK nuclear industry is critically dependent on European goods and services in the nuclear supply chain and their specialist nuclear skills. Leaving Euratom will inevitably increase nuclear costs and will mean further delays."

EDF has rejected the suggestion that the UK's withdrawal from the treaty would delay Hinkley C.

The UK Nuclear Industry Association has stated that if the UK ceases to be part of Euratom, then it is "vital the government agrees transitional arrangements, to give the UK time to negotiate and complete new agreements with EU member states".

EU must shut coal plants by 2030, says study

- One quarter of plant must switch off by 2020
- Renewables alone not enough to hit climate targets

Junior Isles

The European Union must close all 315 of its coal fired power plants by 2030 in order to meet its commitments under the Paris climate agreement, a Berlin-based research institute has said.

According to a report titled: 'A stress test for coal in Europe under the Paris Agreement' by Climate Analytics, emissions from coal in the EU electricity sector need to be close to zero by 2030 (95 per cent by 2030; 100 per cent by 2031), with a quarter of operating coal fired power plants switched off before 2020 and a further 47 per cent going offline by 2025.

Climate Analytics has calculated that to stay within the Paris Agreement's long term temperature limits of "well

below" 2°C and "pursuing efforts to limit the temperature increase to 1.5°C," the EU's CO₂ emissions budget for coal in the power sector is around 6.5 Gt by 2050. The EU will exceed its Paris Agreement-compatible coal emissions budget by 85 per cent if its existing coal fired power plants continue operating to their full lifespan.

"Not only would existing coal plants exceed the EU's emissions budget, but the 11 planned and announced plants would raise EU emissions to almost twice the levels required to keep warming to the Paris Agreement's long term temperature goal," said Dr Michiel Schaeffer, Climate Analytics Science Director, presenting the report at an event in Brussels.

Paola Yanguas Parra, a lead author of

the report said: "We find the cheapest way for the EU to make the emissions cuts required to meet its Paris Agreement commitments is to phase out coal from the electricity sector, and replace this capacity with renewables and energy efficiency measures." Parra said Germany and Poland had the most work to do as they were together responsible for 54 per cent of emissions from coal.

In a separate report, however, scientists warned that expansion of renewable energy cannot by itself stave off catastrophic climate change. They reported in the journal *Nature Climate Change*, that wind and solar alone are not sufficient to meet the goals. Their research found that while "the rapid deployment of wind, solar and electric

cars gives some hope", renewables "have – so far – barely made a dent".

The report warns that unless emissions from fossil fuels go down, "the 2°C target is an impossibility".

The Paris Agreement and the global divestment in coal fired generation campaign secured one of its biggest victories last month, after banking giant Deutsche Bank announced it would halt investment in new coal projects in line with its commitment to the international climate change treaty.

In a statement on its website under the heading 'amended guidelines for coal financing', Deutsche Bank says neither it nor its subsidiaries will "grant new financing for greenfield thermal coal mining and new coal fired power plant construction".

Energy transition under way, according to BP Energy Outlook

The 2017 edition of the *BP Energy Outlook* has highlighted that the energy transition is well under way. The company's annual outlook, which looks at long-term energy trends and develops projections for world energy markets over the next two decades, notes that renewables are projected to be the fastest growing fuel source, growing at an average rate of 7.6 per cent per year, quadrupling over the period.

At the launch of the outlook, Bob Dudley, BP Group Chief Executive said: "The global energy landscape is changing. Traditional centres of demand are being overtaken by fast-

growing emerging markets. The energy mix is shifting, driven by technological improvements and environmental concerns. More than ever, our industry needs to adapt to meet those changing energy needs."

According to the outlook, global energy demand will increase by around 30 per cent between 2015 and 2035, or an average rate of 1.3 per cent per year. This, it says, will largely be met by fossil fuels.

The outlook stresses that, despite the surge in renewables, oil and gas, together with coal, will remain the main source of energy powering the world economy, accounting for more than 75

per cent of total energy supply in 2035, compared with 86 per cent in 2015.

It also highlights that emissions are slowing as a result of the transition. Carbon emissions are projected to grow at less than a third of the rate seen in the past 20 years, by an average of 0.6 per cent per year versus 2.1 per cent per year, reflecting gains in energy efficiency and the changing fuel mix.

If achieved, it would be the slowest rate of emissions growth for any 20-year period since records began in 1965. However, carbon emissions from energy use in the base case are still projected to grow throughout the period, by about 13 per cent. This is far

in excess of the IEA's 450 Scenario, which suggests that carbon emissions need to fall by around 30 per cent by 2035 to have a good chance of achieving the Paris goals.

The outlook develops two alternative cases to explore the potential implications of a faster transition to a lower carbon environment.

"The timing and form of government policy to encourage and facilitate the energy transition is important," said Bob Dudley. "In BP, we continue to believe that carbon pricing has an important part to play as it provides incentives for everyone – producers and consumers alike – to play their part."

Wind power shows strong numbers but down on 2015

Annual wind power statistics recently released by the Global Wind Energy Council show continued strong growth in 2016, although the global market was less than 2015's record total.

According to the report more than 54 GW was added in 2016, bringing total global installed capacity to nearly 487 GW. The market was led by China, the US, Germany, and India but there were also surprisingly strong showings from France, Turkey and the Netherlands.

"Wind power continues to grow in double digits; but we can't expect the industry to set a new record every single year," said Steve Sawyer, GWEC Secretary General. "Chinese installations were an impressive 23,328 MW, although this was less than 2015's spectacular 30 GW, which was driven by impending feed-in tariff reductions. Also, Chinese electricity demand growth is slackening, and the grid is

unable to handle the volume of new wind capacity additions; although we expect the market to pick up again in 2017." The Chinese offshore market began what many hope is the sector's long awaited take-off in 2016, with China passing Denmark to achieve third place in the global offshore rankings, after the UK and Germany.

US installations in 2016 (8,203 MW) were nearly equal to 2015, bringing the US total to more than 82 GW. Notably, the US has more than 18 GW under construction or in advanced stages of development, a harbinger for a strong market again in 2017. Canada (702 MW) and Mexico (454 MW) posted solid though modest gains.

India set a new national record with 3,612 MW of new installations, 2016's 4th largest market. This brings the country's total to 28,700 MW, consolidating its 4th position in total

cumulative installations as well.

The report says Europe had "a surprisingly strong year", given the policy uncertainty that plagues the region, posting modest gains with an annual market of 13,926 MW, of which the EU-28 contributed 12,491 MW. Germany had another strong year, installing 5,443 MW to bring its total capacity to more than 50 GW, only the third country to reach that milestone. France also had a strong year with more than 1,500 MW, and Turkey broke the 1 GW barrier for the first time, installing 1,387 MW. The Netherlands entered the global top 10 in terms of annual market for the first time, with 887 MW, most of which was offshore.

"The cost of wind power continues to plummet, and this is particularly the case for the European offshore sector, which has met and exceeded its 2020 price targets by a substantial margin, and

five years early," according to Sawyer.

Brazil once again led the Latin America market, although the country's political and economic woes resulted in a market which added just over 2 GW (2014 MW), but which still pushed the country over the 10 GW mark as it ended the year with 10,740 MW. Chile posted a record year with 513 MW installed, bringing its total to 1,424 MW, and Uruguay added 365 MW for a year-end total of 12,100 MW. Although Argentina had no new installations in 2016, it now has a solid pipeline of more than 1,400 MW, which will be built out over the next couple of years, the GWEC stated.

"Overall, the industry is in pretty good shape", concluded Sawyer, "with new markets emerging across Africa, Asia and Latin America, and the traditional markets in China, the US and Germany continuing to perform well."



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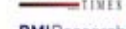
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Rising prices keep gas in check

Coal could make a brief comeback in the US generating mix if gas plant developers postpone projects because of rising prices.

Siân Crampsie

The expansion of the gas fired power generation sector in the USA could be kept in check by rising natural gas prices in the next few years, according to the US Energy Information Administration (EIA).

The trend could provide a window of opportunity for coal plant to increase its market share once more after several years of decline, the agency said.

According to the EIA, natural gas fired generating capacity in the US could reach its highest levels since 2005 if all the new natural gas fired

power plants planned for this year and next come online.

However, natural gas prices are forecast to rise throughout 2017 and 2018, a factor that could lead developers to postpone or cancel some gas fired additions.

The EIA's *Short Term Energy Outlook* (STEO) indicates that natural gas' share of US electricity generation could fall from 34 per cent in 2016 to 32 per cent this year, whereas coal's share could rise from 30 per cent to 32 per cent.

Natural gas is likely to remain dominant over coal in the long term,

however, due to its dominance of new capacity additions over the last 20 years, and planned coal retirements.

The number one source of new electric generating capacity in the USA last year, however, was solar energy.

According to the Solar Energy Industries Association (SEIA), the US installed 14 625 MW of solar photovoltaic (PV) capacity in 2016, nearly doubling its previous annual record of 7493 MW set in 2015.

Solar accounted for 39 per cent of new capacity installations, SEIA said in a report published in conjunction with GTM Research. Installed solar

capacity in the country now stands at over 42 GW.

SEIA is one of a number of organisations campaigning to highlight the contribution made by the renewable energy sector to the US economy.

A recent report by the US Department of Energy found that renewable energy companies in the country employ more personnel than the coal, oil and gas power sectors combined.

The report found that the solar and wind industries – including manufacturing, installation, and transmission – employed 476 000 workers in the US electricity sector last year, compared

to just 187 117 employees in coal, oil, and natural gas electricity generation combined, despite the fact that fossil fuels still account for more than 90 per cent of the electricity produced in the country.

The report will provide some reassurance to the renewable energy sector, which has voiced concerns over the direction of President Donald Trump's future energy policy.

At the end of January a member of the US President's transition team told reporters that Trump would look to pull the USA out of the Paris climate agreement.

Wind prospects in Argentina grow

- Argentina has pipeline of 1.4 GW
- Brazil plans de-contracting tender

Argentina has a strong pipeline of wind energy projects to be built in the next few years and is likely to tender for a further 1 GW of capacity in 2017.

Its prospects are a turnaround for the previously stagnant Argentinean market and will add to the overall strength of South America's growing renewables sector.

The Global Wind Energy Council (GWEC) said last month that although Argentina had no new wind installations in 2016, it now has a pipeline of more than 1.4 GW. Further tenders totalling 1 GW are anticipated this year in order for the country to reach targets set out in its renewables energy law.

Last year Argentina awarded 17 contracts for a total of 1.1 GW of renewable energy in the RenovAr 1.0 tender, including 12 wind power projects of a combined 700 MW. In November, the Energy Ministry awarded 20-year power purchase agreements (PPAs) to 30 projects in the RenovAr 1.5 renewable energy auction, including 10 wind power projects of 765 MW in total.

Most of these projects are due to be operable in 2018.

GWEC data shows that Brazil remains Latin America's leading wind market in spite of the country's economic woes.

Brazil accounted for two thirds of Latin American wind power growth last year, with developers adding a total of 2.01 GW of new capacity to bring cumulative installed capacity to just under 11 GW.

However, wind development in Brazil could slow from 2019 onwards due to a lack of tenders, according to the Brazilian Wind Power Association (ABEELICA). It expects additions of wind capacity to plateau at around

2.3 GW in 2017 and 2018.

ABEELICA said in a report that demand for new capacity is slowing due to a surplus and Brazil's government is planning a de-contracting tender for un-built or unfinished plants before it decides whether it will hold an auction to contract wind or solar for 2019 or 2020.

The rate of new capacity additions is likely to fall to 1.3 GW in 2019 and 555 MW in 2020, said ABEELICA. De-contracted projects could include those having difficulty securing grid connections, or those that weren't built because of the bankruptcy of Argentine turbine maker Impsa.

Chile was Latin America's next most prolific wind developer, expanding its installed capacity by 513 MW in a record year. It now has 1.42 GW of installed wind capacity.

Uruguay, Peru, the Dominican Republic and Costa Rica also had "significant installations" of wind in 2016, GWEC said.

Solar power capacity is also expanding in Latin America.

Last month the government of Argentina's Jujuy province signed a deal with Enel Green Power to install 100 MW of PV capacity in Puna region.

The Cauchari IV PV plant follows the development of Cauchari 1, 2 and 3 by Jujuy's State Energy and Mining Society (JEMSE). The first three plants each have a capacity of 100 MW.

In Brazil, EDF and Canadian Solar announced they have started construction of the 191 MW Pirapora IPV farm. Deliveries of solar modules to the site, in Minas Gerais state, have started.

EDF bought an 80 per cent stake in the project from Canadian Solar in 2016.

Brattle recommends electrification

Electrification of the USA's heating and transport systems would help the country to cut emissions of carbon dioxide (CO₂), according to Brattle Group economists.

The Brattle Group has released a white paper indicating that greater electrification of the economy would enable utilities to nearly double sales by 2050 while cutting energy sector CO₂ emissions by 70 per cent.

Analysis of the technical potential for electrification finds that full electrification of land-based transportation could increase total electricity demand by 2100 TWh, or 56 per cent

of 2015 electricity sales, if battery electric vehicles (BEV) were to become the exclusive mode of transportation. Additionally, full electrification of heating would involve an increase in electricity demand by 2050 of about 1500 TWh, or 40 per cent of 2015 electricity sales.

The white paper also finds that coupling electrification of heating and transportation with significant decarbonisation of the power sector could lead to more than a 70 per cent reduction in US energy related greenhouse gas emissions compared with 2015 levels.

It is likely that utilities would have to lead the way in making changes, however, Brattle Group said.

"The positive outlook outlined in our analysis is not likely to occur without utilities playing a leading role to set the path forward for modernising and decarbonising sectors in which it has not traditionally been involved," said Jürgen Weiss, a Brattle principal and co-author of the white paper. "This will also require collaboration with other civic and regulatory agencies to establish complementary incentives in those parallel sectors."

Wind prospects strong in Canada

Prospects for growth in Canada's wind sector are expected to remain strong for several years, according to the Canadian Wind Energy Association (CanWEA).

CanWEA said that the country installed 702 MW of new wind capacity in 2016 and expects a further 700 MW to be deployed in 2017. Canada's wind energy capacity now stands at just under 12 GW, enough to meet six per cent of electricity demand.

Wind energy procurement programmes in Alberta and Saskatchewan

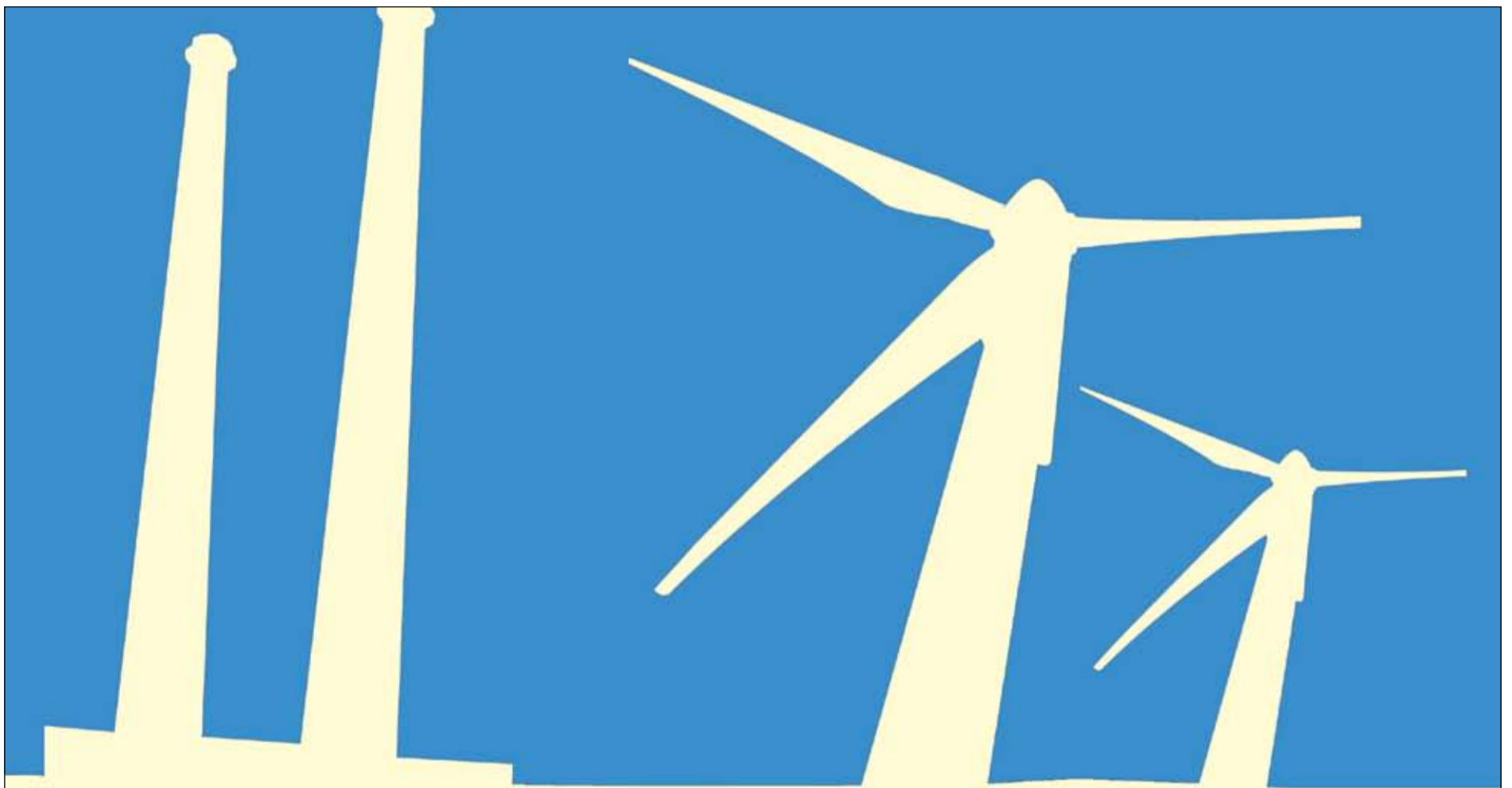
are expected to help maintain a strong pipeline of projects in the country for several years. The country's renewed focus on becoming a low carbon economy is also expected to drive development.

"More wind energy has been built in Canada in the last 11 years than any other form of electricity generation, and for good reason," said Robert Hornung, CanWEA President. "Costs for wind energy have fallen dramatically over the past seven years, making wind energy one of Canada's two

most cost-competitive sources of new electricity supply.

"And unlike natural gas, wind energy is not impacted by carbon prices or commodity price fluctuations, meaning that wind energy will only become more affordable over time."

Last year, Canada commissioned 21 wind farms in the provinces of Ontario, Quebec and Nova Scotia. Of the newly commissioned plants, 16 are owned, at least partially, by aboriginal or local communities, or municipal governments.



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India could phase out coal as renewables costs plummet

■ No new coal plant additions needed after 2025 ■ Solar auction attracts bids below Rs3.0/kWh

Syed Ali

India could phase out coal fired power generation by 2050 if the costs of both renewables and battery storage keep falling at their current trajectories, according to a recent report by The Energy and Resources Institute (Teri).

The organisation says the cost of electricity from renewables could come down to half their current price levels by 2025 if the current trend continues, meaning that no new coal fired plants would be needed after that date.

Under scenarios projecting high growth levels of green energy, and assuming energy storage technology would become viable beyond 2027, the report titled *Transitions in the Indian Electricity Sector*, says the price

of electricity from renewable energy storage achieves parity with the price of electricity generated from domestic coal sources at prices below Rs5/kWh (US7.5 cents/kWh).

"This is perfectly achievable if government gets its policies right," said Ajay Mathur, director-general of Teri. "India's power sector could be coal-free by 2050."

He noted, however, that the government would have to put policies in place to enable the electricity system to run mainly on renewables. For example, ministers will have to allow companies operating the grid to buy power in an instant. "If a cloud comes over a large solar farm, the grid should be able in an instant to buy power from a stored source – most likely batteries," said Mathur.

The huge interest in solar has seen

recent prices fall to an all-time low. Bids submitted for solar power in India fell to Rs2.97/kWh on February 10th, after a World Bank-backed auction helped the central Madhya Pradesh state tender 750 MW of power.

However, concern remains among some industry analysts that the auction format may struggle to catch on or could erode developer profitability. "The fear is that media, government officials and analysts will hype up the low bids and other states will then start pressuring developers to match," said Mercom Capital Group CEO, Raj Prabhu, in a statement.

Nevertheless, developers continue to flock to the market. In February Tokyo Electric Power Co (Tepco), and Chubu Electric Power Co. announced plans to jointly buy a 10 per cent stake

in Indian renewables firm ReNew Power Ventures Pvt Ltd. The companies have set up a joint venture, Jera, which will invest about \$200 million in ReNew Power, an independent power producer (IPP) with more than 3000 MW of wind and solar power plants that are already commissioned or under construction in India.

According to the latest *BP Energy Outlook* India's demand for renewable energy is expected to grow by seven times by 2035, which means the share of renewable energy in the country's fuel mix will increase from 2 per cent to 8 per cent in 2035.

The trend will be instrumental in helping the country meet its climate change commitments. The Teri report also claimed India can cut its CO₂ emissions by up to 10 per cent or 600 million tonnes after 2030 if renewable

energy and storage become less costly than coal within a decade.

India is one of the world's largest greenhouse gas emitters, third to China and the US. In 2014, the country became the biggest contributor to global emissions growth after emitting 8.1 per cent more than the previous year. In 2015, it increased by another 5.2 per cent.

Under the Paris Agreement India has committed to sourcing at least 40 per cent of its electricity from non-fossil fuel sources by 2030, including the deployment of 175 GW of renewable energy capacity by 2022.

■ Global wind energy technology company Gamesa has inaugurated its new factory in the Nellore region, in the state of Andhra Pradesh, one of the country's fastest growing wind power producing regions.



Indonesia electrification gathers pace

Indonesia took several important steps last month in its effort to achieve its goal of increasing nationwide electrification to 99.7 per cent by 2025, up from around 90 per cent today.

In February the Timika office of state-owned electricity company Perusahaan Listrik Negara (PLN) said it will build 21 power plants in the districts of Mimika and Yahukimo in 2017.

"This year we will build 21 power plants in the sub-districts of the two districts, which have not yet been covered by electricity networks, one of which is Agimuga in Mimika," said PLN's Area Manager for Timika, Salmon Karet. "We have planned that by 2019, PLN's network will supply electricity to all sub-districts."

In 2015, Indonesia embarked on a programme to add 35 GW of capacity by 2020 to provide the additional generating capacity needed to help it meet its electrification target.

The bulk of this new capacity will come from coal. Those plans inched forward with last month's announce-

ment that Korea East-West Power Corporation (EWP) received funds for a coal fired power plant it is constructing on a build-operate-transfer (BOT) basis in Jakarta. An official from EWP said the plant will start commercial operation in March 2019.

The announcement followed news that Adaro Energy, Indonesia's largest coal miner by market capitalisation, achieved the financial closure of a loan deal with six foreign lenders for the construction of a 200 MW power plant project in Tabalong, South Kalimantan.

The planned contribution from gas fired generation also moved forward in February when PLN signed a power purchase agreement (PPA) with Jawa Satu Power, an incorporated joint venture mandated to develop the \$1.8 billion Java 1 combined cycle power plant (PLTGU) after a prolonged disagreement. Java 1 power plant will have a total capacity of 1760 MW, 10 per cent bigger than its initial plan, and will supply electricity to

PLN for 25 years

Renewables will also play a significant role in the country's electrification programme. The government has set a target of renewable energy contributing 23 per cent of the total energy supply by 2025. Currently, its contribution is only 14 per cent.

That target received a financial boost last month when the World Bank's board of executive directors approved \$55.25 million in grants to support geothermal energy projects in Indonesia with the aim to facilitate investment in geothermal power generation.

In a separate development, PLN in Papua and West Papua (WP2B) signed an agreement with PT Merauke Mada Energi to develop biomass power plants in Merauke.

Announcing the agreement, PLN WP2B general manager, Yohanes Sukrislisono, said: "PT Merauke Mada Energi will develop a renewable power plant that will use biomass energy, which is expected to start production in 2017."

Australia invests in renewables as costs fall

Australia's Clean Energy Council (CEC) has said investment in the renewable energy sector is occurring due to "extraordinary cost reductions".

According to the CEC's Chief Executive Kane Thornton, investor confidence in the sector has rebounded after several years of destabilisation under the Abbott government.

"This investment is... underpinned by the bipartisan support for the 2020 Renewable Energy Target (RET) as well as support from the Australian Renewable Energy Agency, the Clean Energy Finance Corporation and various initiatives of state and territory governments," he said.

Thornton added that renewable energy is the cheapest form of new energy generation to build today and called for long-term clarity beyond 2020 to sustain the current levels of investment.

According to the CEC, a total of 22 large-scale renewable energy projects, representing 2256 MW of capacity, are currently being built in Australia or will startup this year. The projects represent an investment of more than A\$5.1 billion (\$3.9 billion) and will create almost 3000 direct jobs.

Investor confidence in the sector was highlighted in February when Australia's Clean Energy Finance Corpora-

tion (CEFC) committed A\$75 million to a new renewable energy fund that aims to invest up to A\$500 million to speed up the development of clean energy projects.

The green finance institution said that with its cornerstone commitment it wants to attract mid-tier investors, who often lack the scale to invest in projects directly, as well as large institutional investors.

The vehicle, the Palisade Renewable Energy Fund (PREF), is managed by Palisade Investment Partners (Palisade). The fund will focus on both construction and operating assets and will also be able to consider late-stage development opportunities.

Meanwhile, the city of Toowoomba and the surrounding Darling Downs region in southern Queensland looks set to become a solar power capital in Australia, with six projects worth nearly \$2 billion in the pipeline.

By far the largest in the works in terms of size, cost and output, is the Bulli Creek project, a joint venture between US-based SunEdison and Australia's Solar Choice.

Once completed in 2025, the \$1 billion solar farm will be capable of producing 2 GW of electricity. It will also create 2739 jobs over the life of the project.

Capacity auction fuels UK energy debate

Proponents of the UK's capacity market say it is delivering energy security at a good price, but critics say it is just paying generators to keep dirty generating plant operating.

Siân Crampsie

The UK's latest capacity market auction has again sparked a debate in the country about energy policy, environmental goals and power prices.

The latest auction, aimed at securing capacity for the winter of 2018/19, awarded just over 54 GW of capacity at a price of £6.95/kW.

While the price is the lowest yet achieved in the UK's capacity market, it drew criticism for supporting fossil fuel fired capacity rather than stimulating investment in new, cleaner technologies.

Gas fired generators secured 40 per cent of the capacity in the latest auction, while coal and biomass plants won a further 20 per cent of capacity. The system is therefore at odds with government policy to cut carbon

emissions, critics say.

"The government has rightly proposed phasing out coal power stations, so instead of taxing them on one hand and paying them subsidies on the other, they should be setting a clear legal framework to progressively drive down climate pollution, and create market opportunity for clean power production," said Dr Doug Parr, Policy Director at Greenpeace UK.

Other groups – including Renewable UK and Scottish Power – have called for coal fired power stations to be banned from the auctions, which are technology neutral and designed to ensure that the lights stay on in the UK as generating margins are eroded due to plant retirement.

There are also concerns about the amount of diesel-fired capacity that has won contracts in this and earlier

auctions.

"Diversity is important in security, and being technology-neutral, the capacity market has the potential to encourage a broad mix of resources to participate," said Dr Alastair Martin, founder and chief strategy officer at Flexitricity. "It has largely delivered this in all but one category – new-build generation.

"Under the capacity market, it's possible to get a 15-year contract if you're building a new generation site, but everyone else must take shorter contracts. This means that [it] strongly favours low-capex projects. This delivers one thing: engine farms – rows of reciprocating engines, gas or diesel, in shipping containers."

The UK government has lauded the results of the latest auction because of the low clearing price. The latest auction will add around £378 million in

total to business and home energy bills this year, increasing business energy costs by approximately 1 per cent, according to Inprova Energy.

However the low price has led some to question the need for the additional capacity next winter. It achieved such a low price because market participants have better visibility in a year-ahead auction, compared to auctions seeking capacity for four years ahead, Martin told *TEI Times*.

The four year-ahead (T-4) auction held at the end of 2016 set a clearing price of £22.50/kW – closer in price to earlier T-4 auctions.

A recent report by First Utility, one of the UK's biggest independent energy suppliers, said that UK households face a 42 per cent rise in the amount they pay to support government energy initiatives including smart meter rollouts, the capacity market and

renewables obligation (RO) scheme.

All three of the big six energy providers that have so far announced price rises this year – Npower, EDF Energy and ScottishPower – have cited an increasing costs due to government policies, as well as rising wholesale prices, for their decisions.

"It's bizarre, frankly, to see energy suppliers such as Npower blaming the capacity market for raising bills," said Richard Black, director of the Energy and Climate Intelligence Unit (ECIU). "It's basically handing energy companies cash for doing very little, as almost all of the power stations covered by the contracts would be operating anyway – it's a straight payment to their profits. In an efficient market you'd expect to see competition eroding that additional profit margin, effectively bringing bills down close to where they were before."

Atlantis weighs in on Tidal scheme

- Hendry report boosts confidence
- Mott MacDonald to advise Northern Gateways

Marine energy firm Atlantis Resources has put a newly created division, Atlantis Energy, to work with an agreement to help develop a proposed tidal barrage scheme in northwest England.

Atlantis recently launched the new business unit to take advantage of business opportunities outside its core tidal stream sector. It has formed a partnership with Natural Wyre Energy (NEW) to develop the 160 MW Wyre project on the Lancashire coast.

Earlier this year, Atlantis Energy said it would join forces with French firm Ideol to develop up to 1.5 GW of floating offshore wind capacity.

Atlantis Energy's agreement with NEW comes just weeks after the publication in the UK of a government-commissioned review into tidal lagoon technologies by Charles Hendry, a former energy minister.

The review concluded that the UK's tidal resources are a potentially

reliable and affordable source of energy.

"This project is absolutely in line with Charles Hendry's recommendations to build momentum in this new industry and with the Secretary of State's ambition for affordable, reliable energy supply with a strong domestic supply chain focus," said Tim Cornelius, CEO of Atlantis. "The Wyre project is an opportunity to develop an extremely cost effective tidal range project... we can bring this project to reality very quickly."

Other tidal barrage projects in the UK also appear to be moving forward in the wake of the Hendry review.

In February Northern Tidal Power Gateways said it had appointed Mott MacDonald as an advisor for its proposed schemes across Morecambe Bay and the Duddon Estuary.

These schemes would not only generate a combined 6600 GWh/year, but also improve transport links in the

region through the construction of new road links.

The Wyre project would involve construction of a 600 m-long barrage across the Wyre between the industrial town of Fleetwood and the village of Knott End. Benefits of the project include flood protection and economic regeneration, NEW says.

Last month marine energy developer Minesto said it had expanded plans to develop a novel tidal stream project in Holyhead Deep, North Wales.

Minesto holds a leasing agreement for the development of a 10 MW project at the site using its innovative Deep Green technology, but has applied to UK consenting authorities to develop 80 MW.

Expanding its plans will enable the company to take advantage of economies of scale and reduce the cost of energy by more than 50 per cent, Minesto said.

Europe marks record wind year

Investment in wind energy reached a record high in 2016, but the future of the industry remains uncertain, says WindEurope.

WindEurope has released new data showing that investment in new onshore and offshore wind farms reached a record €27.5 billion last year. Wind accounted for 51 per cent of all new power installations in 2016, and installed wind capacity in the region now stands at over 153 GW, it said.

The data shows that wind energy is "now a mainstream and essential part of Europe's electricity supply," said Giles Dickson, CEO of WindEurope.

Onshore wind investment is falling, however, and over half of EU member states invested nothing in wind energy last year.

"With all the talk about the transition to low-carbon, things should be looking good long-term for the wind industry in Europe. But they're not," said Dickson. "Only 7 out of 28 EU Member States have targets and policies in place for renewables beyond 2020."

"We still have dysfunctional electricity markets that are not fit for renewables. And we're lacking long-term price signals to support investment."

French plans clear EU rules hurdle

France is moving ahead with plans to boost its renewable energy capacity after an endorsement of three schemes by the European Commission.

The three schemes will enable France to develop over 2600 MW of solar and hydropower capacity and have been cleared by Brussels under European State Aid rules. The country has set an ambitious target of reaching 40 per cent renewable electricity by 2030 and is also looking at ways of making its electricity system more flexible.

The two solar schemes have a combined provisional budget of €8.8 billion over 20 years, while the hydropower scheme has a provisional budget of €500 million over 20 years. They will "stimulate a greater use of renewable energy sources and provide legal certainty to the sector, while limiting the use of state support", EU Competition Commissioner Margrethe Vestager said.

The solar scheme is based on a feed-in tariff (FiT) support system for operators of small, medium and large-scale solar installations. The hydropower scheme will grant support for up to 60 MW of new hydropower

plants. The beneficiaries will be selected through a tender.

France is also making strides to make its power system more flexible, according to a new report by Clean Horizon.

The report says that a call for 50 MW of solar-plus-storage in the French islands coupled with the recent opening of the ancillary services markets and the new self-consumption regulations will make France a key market for energy storage.

France recently followed Germany's example and opened its ancillary services market and joined the common European auction for primary reserve this January. Moreover, the French energy transition law has set the principles for flexibility services contracting and remuneration, and recent regulations go as far as defining the administrative procedure for a project to be proposed to the distribution system operator.

France also held its first capacity market auction in December 2016, awarding 22.6 GW of capacity and thus giving positive signals for energy storage, Clean Horizon said.

SA nuclear programme attracts interest

■ Nuclear vendors respond to 9.6 GW plans ■ RFPs expected this year

Siân Crampsie

Some 27 companies have indicated that they are planning to participate in South Africa's nuclear new build programme.

South African utility Eskom said the firms had responded to the request for information (RFI) it issued in December last year. Both Rosatom and EDF issued statements last month indicating they had met the first deadline in the procurement process.

"Eskom is looking forward to the

information supplied to confirm our understanding of the key issues that impact the timing and affordability of a nuclear programme," said Eskom acting CEO Matshela Koko.

EDF said in a statement on 25 January that the French utility – with support from French authorities – had formally declared its intention to submit a response to that RFI. Responses have also been received from companies in China and South Korea, according to local media.

The RFI is the first step in a process

aimed at procuring 9600 MW of capacity. It asks companies that wish to submit bids to supply nuclear power station technology to South Africa to indicate that they are intending to bid, by answering a number of questions. The questions relate to localisation of construction and fabrication technology, training schemes, intellectual property sharing and exposure, and a number of other issues.

"The basic idea of the 'fleet approach' for the 9600 MW of power is that as one reactor is being built, that

the acquired technology skills are then seamlessly moved over to the next reactor," said Phumzile Tshelane, CEO of Necsa, South Africa's nuclear energy company. "In this way we not only establish new technology foundations, but we also keep costs down by using a production line system."

Eskom is intending to issue two requests for proposals (RFPs) later this year, relating to the financial and technical aspects of the nuclear bids. Time frames for construction, and nature

and method of construction, will also be agreed between the parties at this stage.

■ Italian renewables developer Enel Green Power has brought two large-scale solar power plants into commercial operation in South Africa. The Adams and Pulida solar PV plants, located in Northern Cape and Free State provinces, respectively, generate 82.5 MW and will sell their energy output to South African national utility Eskom under 20-year power purchase agreements.



Innovation in renewables gathering pace

- Clean energy investment no longer linked to oil price
- Deployment is a barrier

Technology innovation is continuing to play a critical role in the evolution of the renewable energy sector, according to a report by Lloyd's Register.

In an analysis of the low carbon sector, the Lloyd's Register Technology Radar found that low carbon generation technologies are cost competitive with fossil fuel technologies, and that advances in solar cell technologies are likely to have a major impact on the industry.

It also concludes that technology developments are making a low carbon future a reality, not only by bringing down costs, but also by making existing technologies more efficient. The link between oil prices and low carbon technology uptake is breaking, it said.

"We are very encouraged by the findings, which highlight not only a growing optimism across the industry but a vigorous and intelligent debate about the pathways to decarbonisation," said Alasdair Buchanan, Energy Director of Lloyd's Register. "Clearly, there are many uncertainties about exactly how the industry will evolve, but what is inarguable is that the conversation is

no longer about "should we?" but "how should we do it?"

The report is based on the insights and opinions of leaders across the low carbon sector, as well as the views of almost 600 professionals and experts around the world – from utilities and distributors through to operators and equipment manufacturers.

Other findings include the fact that implementation of technology in renewables is hindered by deployment, and that greater standardisation in regulations globally could speed up deployment and further reduce costs.

Respondents in the Lloyds research also believe that electrical technologies, rather than mechanical storage or chemical technology innovations, will transform the storage sector. In particular, respondents expect super-capacitors, which will rapidly speed up charging times for large batteries, to have the greatest impact on storage.

In addition, software advances will be instrumental in transmission and distribution, Lloyds said. They were seen by respondents as the innovation that will be the quickest to arrive and the most likely to be adopted.

Saudi Arabia commissions first wind turbine

The Kingdom of Saudi Arabia is planning to launch a renewable energy tender later this year in a bid to boost clean power capacity.

Bloomberg reported last month that the tender would involve 300 MW of solar and 400 MW of wind energy, and will take place in September, citing energy minister Khalid Al-Falih as a source.

Al-Falih told reporters that the country would offer "motivating" terms in the contracts in order to attract investment and competitive bids. The country is targeting between \$30 billion and \$50 billion of investment in renewable energy and waste-to-energy

projects by 2023.

Saudi Arabia recently celebrated the commissioning of its first wind turbine, a GE unit installed at a Saudi Aramco facility in Turaif in northwestern Saudi Arabia.

The unit provides electricity to the Saudi Aramco facility and is seen as a key step in the realisation of Saudi Arabia's national renewable energy target of 9.5 GW, defined in Saudi Vision 2030 and the National Transformation Plan (NTP).

The GE 2.75-120 wind turbine includes a desert protection package specifically designed for the Kingdom's 'hot & harsh' conditions. The

tower stands 85 m high, capturing energy with blades 120 m in diameter and a blade tip height of 145 m.

■ Saudi Arabia has cancelled a contract with South Korea's Samsung Engineering for the construction of a 3100 MW power and desalination plant at Yanbu Industrial City on the Red Sea coast. The \$3 billion project was awarded by state-owned Saline Water Conversion Corporation to a consortium led by the Korean firm in 2012. Samsung Engineering said that it had received payments of \$830 million in line with the project's progression, and that the plant is about 55 per cent complete.



The Africa Renewable Energy Initiative (AREI) says it has received information on over 400 projects from around the continent that could be considered for support.

The projects include renewable energy and large hydropower projects as well as programmes focused on energy efficiency, energy access, financing and transmission. Together they could add almost 50 GW of capacity to Africa's grid.

In its 2017 progress report, AREI says that the projects have been submitted by various countries, organisations and development partners, and that it will carefully screen proposals against AREI criteria – which include social and environmental safeguards – before

considering them for support.

AREI was launched at COP21 in Paris in December 2015 to harness Africa's renewable energy potential and expand energy access across the continent. It is strong international support from development partners, who have committed to mobilising at least \$10 billion cumulatively by 2020 for its programmes.

Around half of the 49.4 GW of capacity proposed is for large hydropower projects (>100 MW) and include large regional projects as well as in-country projects. Around 6700 MW of wind power projects have been proposed, as well as 6300 MW of solar PV and 4100 MW of geothermal.

Energy access projects represent just

3.4 GW of project proposals, while the actual energy gap in Africa is 35-40 GW, AREI said. Three-quarters of the projects are in East Africa, and the remainder in central Africa.

AREI said that its initial assessment of the portfolio indicates that there is an overwhelming preference towards capacity-building projects rather than enabling and transformative programmes such as energy efficiency or energy access. Large regional projects also dominate, it added.

AREI also said that it needs to gather more information from a more diverse set of stakeholders to get a better understanding of the current landscape and the impact that AREI's programmes will have.

Companies News

Wärtsilä buoyed up by energy solutions

Wärtsilä has reported a fall in net sales in 2016 but remains confident that its Energy Solutions business will continue to grow, largely driven by the need for more flexible generation.

Junior Isles

Finnish marine and energy solutions company Wärtsilä is optimistic in its outlook for 2017 despite reporting a decline in net sales in 2016.

In its review period January-December 2016, net sales across its marine, services and energy solutions businesses fell by 5 per cent to €4801 million. Overall performance figures were dragged down by a weak marine environment that saw new-build vessel orders fall to an "exceptionally low level" in 2016.

Its Energy Solutions business, however, proved to be a bright spot as sentiment in the power generation markets improved.

In the first nine months of 2016, global orders for natural gas and liquid fuel power plants of up to 500 MW totalled 17.4 GW, a 2 per cent increase on the previous year. Wärtsilä's market share increased to 15 per cent.

Global orders include all gas turbine and Wärtsilä orders with prime movers over 5 MW in size.

The fourth quarter saw a dramatic increase in order intake, which totalled €501 million for the period – 37 per cent more than for the corresponding period last year.

Commenting on the results, Javier Cavada Camino President, Wärtsilä Energy Solutions, said: "We grew 43 per cent in order intake compared to the previous year. Order intake in 2016 was €1.45 billion compared to €1 billion in 2015."

Notably, Wärtsilä has been re-aligning its energy solutions business to take advantage of the increasing penetration of wind and solar, and growth in decentralised energy. Last year it announced a new business to market hybrid reciprocating engine-solar systems for distributed generation.

"We can deliver engines hybridised with solar and other sources of power,

including battery storage. We can also provide the LNG infrastructure and the key is, we can fully integrate the systems," said Cavada. Wärtsilä says it now has around 1.5 GW of solar and hybrid power plants either under construction or negotiation.

The company has also been continuing to develop what it calls its Smart Power Generation technology, which according to Cavada allows its engines to start up and deliver power to the grid in less than 40 seconds. This, he says, makes it an ideal partner for wind and solar.

Cavada said South America is proving to be "an interesting" market. He noted that in Argentina nearly 600 MW of Wärtsilä engine-based capacity was ordered last year alone to complement new renewable capacity. In 2015 the company's installed base in the country was just 85 MW.

Wärtsilä believes the ability to deliver power quickly and the flexibility of its

technology will also help it in European markets that are increasingly requiring flexible generating capacity.

At the end of January the company was contracted by Centrica to build two 50 MW Smart Power Generation power plants in the UK. The plants were part of Centrica's bid in the UK's recent capacity market auction and will also operate in the balancing energy market.

Melle Kruisdijk, Vice President Europe, Wärtsilä Energy Solutions commented: "The capacity mechanism is not incentivising flexibility – that incentive is coming from the balancing energy market – but it is helping to make these investments happen."

"Centrica procured these flexible units to become active especially in the balancing power market because price signals will become spikier as more renewables come on to the market. The market price signal is what determines which technology is chosen."

In Germany, where a higher value is put on flexibility, the company won an order at the end of last year to deliver a 100 MW cogeneration plant.



Cavada says the ability to deliver fully integrated systems is key

MHPS cuts staff

Mitsubishi Hitachi Power Systems Europe (MHPSE) says that it will realign its business strategy and reduce staff numbers in response to the challenging conditions in the power plant engineering market.

The Germany-based business currently employs around 1000 staff at its Duisberg headquarters and says that its management and works council have started talks around streamlining the organisation.

In a statement MHPSE said that "the decline of the market for new thermal power plant constructions in Germany and Western Europe" had forced it to examine its business strategy.

"Over the past 10 years, MHPSE has successfully handled orders for power plants and key components valued at several billion Euros in Germany and

internationally," it said.

MHPSE will cut staff numbers by more than one-third.

"The energy turnaround has led to a structural rupture across the entire traditional power generation industry," said Rainer Kiechl, CEO of MHPSE. "In part, we managed to shield ourselves from it by tapping markets in Poland and Southeast Europe, and by operating successfully there. But even this could not fully offset the almost complete disappearance of our core market."

Kiechl also noted that the firm had invested in technologies such as energy storage in order to maintain growth. It has developed a long-term strategy to take it through the next few years and "back into a period of growth".

First Solar looks east

First Solar is expanding its footprint into markets across southeastern Europe and central Asia.

The solar module firm has signed a deal with Turkey's Zorlu Holding to distribute its thin film photovoltaic (PV) modules in 26 countries. It follows a similar agreement signed in 2015 with Caterpillar to sell Caterpillar-branded First Solar panels worldwide.

Zorlu will become a distributor of First Solar's modules in Turkey, Afghanistan, Albania, Bosnia, Bulgaria, Cyprus, Georgia, Kosovo, Macedonia, Pakistan, Romania, Serbia, Turkmenistan, the Ukraine, and the Commonwealth of Independent States (CIS). In addition to selling PV modules, Zorlu will undertake its own

project development activity and will power its successful projects with First Solar technology.

The deal is a key component of First Solar's strategy to expand its business geographically. "By leveraging Zorlu's commercial strength in these countries we expect to gain access to module sales opportunities in emerging markets, some of which we have not previously targeted," said Stefan Degener, First Solar's Head of Business Development for Europe, Turkey, and Africa.

As part of the agreement, First Solar will transition its existing Business Development resources in Turkey to Zorlu Solar and will close its office in Istanbul. First Solar established a presence in Turkey in 2014.

Dong stretches green goals

Wind energy has been the engine of growth for Dong Energy and the firm has pinned its future plans on a clean, green strategy.

Siân Crampsie

Dong has underlined its commitment to operating a low carbon business with a promise to bring an end to coal fired generation and invest heavily in the offshore wind energy sector.

The Danish firm is already a leader in the offshore wind sector – accounting for more than one-quarter of the world's installed offshore wind capacity – and is now aiming to reach an installed base of up to 12 GW by the end of 2025.

It has also announced that coal will no longer be in use at its power stations by 2023.

"Our strategy is to continue the transformation of the Group to green energy and to lead the transition towards a more sustainable energy system," wrote Dong CEO and President Henrik Poulsen in a statement in the firm's latest annual report. The firm revealed in February a net profit for 2016 of DKK12.2 billion (\$1.73 billion), with

earnings from its wind business doubling to DKK11.9 billion.

"The results for 2016 are highly satisfactory. We have delivered an underlying growth of 95 per cent in operating profit (EBITDA), driven by strong growth in wind power," said Poulsen.

Dong says it will exceed a target set in 2013 to reach 6.5 GW of installed offshore wind capacity by the end of 2020. It is currently involved in the construction of six major offshore wind farms, and has also continued to work on the development of a portfolio of projects for construction after 2020, it said.

Dong has acquired the rights to develop up to 3 GW of capacity in the USA, and is also progressing the development of four projects in the Changhua region of Taiwan, which could reach a combined capacity of 2 GW. In January it concluded an agreement to acquire a 35 per cent stake in the Formosa 1 offshore wind

project in Taiwan.

These projects will benefit from continued falling costs in the offshore wind sector, technical innovations and Dong's growing experience, the firm said, noting a number of important milestones reached by its wind business in 2016.

Last year Dong completed the construction of the Gode 1 & 2 wind farms, and made the final investment decision for the 1.2 GW Hornsea 1 project in the UK. It also won contracts for the Borssele 1 & 2 wind farms in the Netherlands, and gained consent for Hornsea 2.

Dong said last month that it had already reduced its coal consumption by 73 per cent since 2006. "We've decided to take the final step and phase out the use of coal at all our power stations," said Poulsen. "The future belongs to renewable energy sources, and therefore we're now converting the last of our coal-fired power stations to sustainable biomass."

10 | Tenders, Bids & Contracts

Americas

Pampa Energia selects wind turbines for Bahia

Denmark's Vestas Wind Systems has won a contract to build a 100 MW wind farm in Bahia Blanca, Argentina, for Pampa Energia.

Under an engineering, procurement and construction (EPC) contract, Vestas will install 29 of its V126-3.45 MW wind turbines at the site of the Corti project. Vestas has also secured a 10-year service agreement for the project.

Delivery is to take place in the third quarter of this year, with commissioning expected in the second quarter of 2018.

Innovative ABB microgrid aids Alaska

Alaska's Chugach Electric Association has placed an order with ABB for an innovative microgrid solution that will improve power stability in the grid in Anchorage.

The project will include installation of battery and flywheel-based energy storage technologies that will enable the integration of more renewable energy capacity and improve the reliability of power supplies.

The PowerStore package will also include ABB's Microgrid Plus control system to monitor the hybrid storage solution and ensure proper load sharing between the two storage mediums. It will also be equipped for remote service and maintenance.

OST to handle Jamaica's largest solar farm

Eight Rivers Energy Company (EREC) has appointed OST Energy as its owner's Engineer for a 37 MW solar power project in Jamaica.

The solar farm is the largest solar power project to date in Jamaica and is being developed by a consortium of partners including Neoen, MPC, Ferrostaal and Rekamniar Frontier Ventures.

OST will provide owner's engineering support to ensure that each stage of the project is properly planned, executed and controlled on behalf of the project's backers.

Omnetric wins Wabash Valley's favour

Omnetric Group, a joint venture between Siemens and Accenture, has been awarded a contract to implement an upgraded demand response and distributed energy management system for Wabash Valley Power.

The solution will be based on a Siemens Distributed Energy Management System and will enable Wabash Valley to integrate more decentralised energy sources across its network. It will also enable the energy cooperative to better manage load across its network and increase savings for members.

By April 2017 the upgraded Siemens solution will be completely deployed. Omnetric will then continue to work with Wabash Valley Power over the following months on pilot projects aimed at managing distributed energy resources across the co-op network, in order to bring more renewable resources onto the grid.

Asia-Pacific

New Gamesa unit debuts in Thailand

Gamesa has secured its first order for its latest wind turbine, the G126-2.625 MW.

The company has signed an agreement with Gunkul Engineering Public Company Limited for the

supply of 20 of the new wind turbine units for the Mittraphap wind farm, located in the province of Nakhon Ratchasima, in southern Thailand. PowerChina Zhongnan Engineering Corporation will carry out the engineering procurement and construction for this project.

The turbines are slated for delivery during the third quarter of 2017 and the project is due to be commissioned in the first quarter of 2018. In addition, Gamesa will maintain the complex for the next 10 years.

This agreement marks the company's third order in Thailand, having already been contracted to supply another 127.5 MW for Gunkul.

Punjab plans smart cities

Hartek Group says it has bagged an order from the Punjab State Power Corporation (PSPCL) for the supply of equipment for three upcoming smart city projects.

India-based Hartek will commission Supervisory Control and Data Acquisition (SCADA) relays at 55 substations in smart grid projects in the cities of Ludhiana, Amritsar and Jalandhar, in India's Punjab state.

By equipping these substations with SCADA relays, Hartek Group will enable collection and storage of information relating to indications for troubleshooting and maintenance.

Suzlon wins repeat order

Suzlon has won a repeat order from a power utility for a 50 MW wind power project in Kutch, Gujarat.

The wind farm will consist of 24 of Suzlon's S97 120 m hybrid tower wind turbines and is due to be completed by March 2017.

Suzlon will execute the entire project on a turnkey basis and will also provide operation and maintenance services for an initial 14-year period.

Gamesa affirms India leadership

Gamesa has won seven new orders in India, reaffirming the firm's position as the leading wind turbine manufacturer in the market.

The seven orders total 278 MW of capacity to be delivered to several customers. Gamesa will supply, install and commission the turbines at all seven developments. Three of them are EPC contracts, the firm said.

In total, Gamesa will supply 99 of its G114-2.0 turbines and 40 of its G97-2.0 MW model. The projects are slated for commissioning between March and October 2017.

EGAT orders H-class CCGT units

Siemens and Marubeni have been awarded a turnkey contract to develop a combined cycle power plant in Bangkok, Thailand.

The South Bangkok power plant will consist of two units in a single shaft configuration, and will also feature the first H-class gas turbines installed in Thailand. It will be commissioned in 2019 and add 1200 MW to the grid, Siemens said.

Siemens will deliver the key components consisting of two SGT5-8000H gas turbines, two SGen5-3000W generators and two steam turbines of model SST5-5000. Also included in the scope of supply are two heat recovery steam generators engineered by NEM and the SPPA-T3000 control system. The consortium partner Marubeni is responsible for civil and erection works, cooling tower, high voltage gas insulated switchyard and some balance of plant equipment.

Europe

OWC wins Iberdrola offshore wind deal

UK-based Offshore Wind Consultants Limited (OWC) has won a new framework agreement from Iberdrola to deliver engineering and project management services for several offshore wind farm projects in East Anglia, UK.

Under the contract, OWC will provide engineering consultancy services for projects including the East Anglia One, East Anglia One North, and East Anglia Three offshore wind farms, as well as delivering project management services for East Anglia One.

EnBW orders Siemens units for Hohe See

Germany's EnBW has placed an order with Siemens for 71 offshore wind turbines for the Hohe See project in the North Sea.

Siemens will supply its SWT-7.0-154 wind turbines, rated at 7 MW, for the project, which will be installed 90 km north of the German island of Borkum. Installation will take place in 2019.

EnBW took a final investment decision on the 500 MW project at the end of 2016 and announced last month that its co-investor would be Canada's Enbridge.

After commissioning, Siemens will perform service and maintenance for a period of at least five years. Grid connection will be established via the BorWin 3 high-voltage DC link and the BorWin Gamma converter platform, which will be installed by Siemens for grid operator Tennet.

Carrefour joins DSR market

Carrefour Hypermarchés is to provide demand flexibility services to French transmission operator Réseau de Transport d'Electricité (RTE) through a new deal with Reactive Technologies Limited.

Under the deal, Reactive Technologies will aggregate and dispatch load flexibility from HVACs and chillers across a portfolio of Carrefour's sites, which include distribution centres, hypermarkets and supermarkets. The partnership has enabled the French supermarket chain to participate in France's new capacity market, it said.

"We selected Reactive Technologies over other DSR [demand side response] providers in the market following a successful trial in which they demonstrated that their unique technology can unlock our assets' flexibility without impacting our day-to-day operations nor affecting food quality, which is of paramount importance to us," said Hervé Duclos, Head of Energy Procurement and Sustainability at Carrefour.

RCG, Axis pen global agreement

The Renewables Consulting Group Limited (RCG) and AXIS Insurance have signed a global consultancy services framework agreement covering technical, commercial and management consulting services for AXIS Insurance's portfolio of renewable energy assets.

Under the agreement, RCG will work with AXIS Insurance to provide greater understanding of the risks and opportunities faced by the global renewable energy industry. This will enable AXIS Insurance to provide its insured clients and brokers with enhanced value and industry leading service.

As well as independent engineering and project appraisals, RCG is assisting AXIS Insurance with claims investigations, expert witness services, management consulting and market intelligence reporting.

Vattenfall commits to Berlin CHP

Vattenfall says it will invest €325 million in the construction of a new gas-fired combined heat and power (CHP) plant in Berlin, Germany.

The plant will have a capacity of 260 MWe and 230 MWth, and will have a thermal efficiency of 90 per cent, Vattenfall said. Construction will start in April 2017, with commercial operation planned for mid-2020.

Vattenfall has selected Siemens as the general contractor for the plant.

Nidec ASI selected for EDF storage project

EDF Energy Renewables has selected Nidec ASI to provide a 49 MW energy storage system that will provide balancing services to the UK grid.

The contract follows a successful bid by EDF in National Grid's Enhance Frequency Response (EFR) tender in 2016, under which a total of 200 MW of energy storage capacity was awarded.

Nidec ASI will provide a battery energy storage system with a total capacity of 49 MW and 25 MWh. It will be built at an existing gas-fired power station in West Burton in the East Midlands region.

Nidec will provide the power conversion system, while EDF will provide the energy management system.

Call for tender for Viking HVDC link

Danish transmission systems operator Energinet.dk and the UK-based National Grid have issued an invitation to tender for the high voltage direct current (HVDC) cables and converters for the Viking Link Interconnector.

The Viking Link is a proposed 1400 MW HVDC electricity link between the British and Danish transmission systems, connecting at Bicker Fen substation in Lincolnshire and Revsing substation in southern Jutland, Denmark.

The new invitation to tender concerns the award of one or more contracts for the detailed design, engineering, procurement, manufacture, installation, construction, testing, commissioning, spares provision, operational handover and maintenance of the interconnector.

The overall value of the contracts is €1.3 billion and the project period is 114 months.

International

Digital plant plans for Turkey

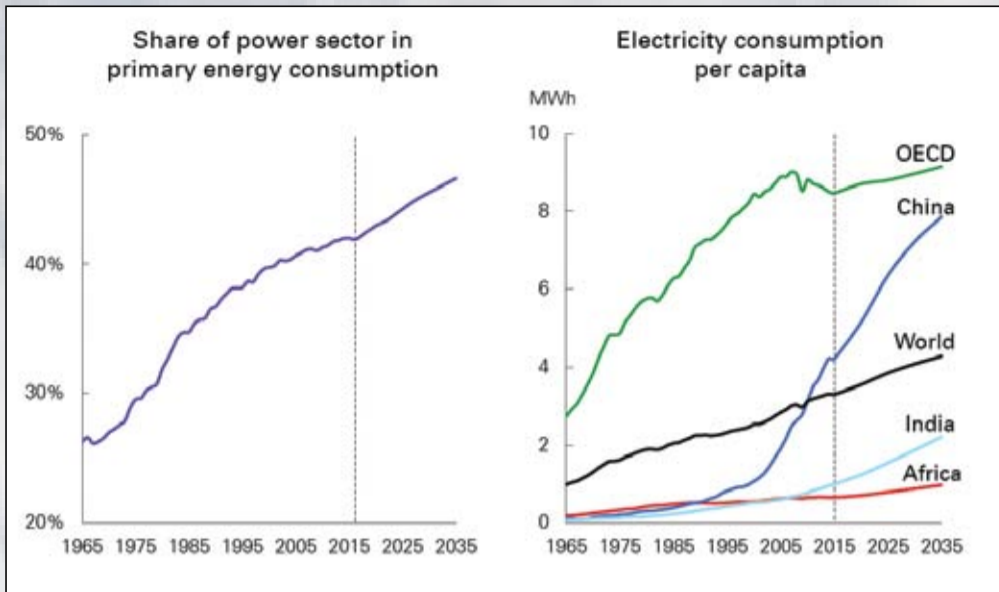
GE and Gama Energy have signed an agreement to operate the first digital power plant in Turkey.

The deal marks the first use of industrial cloud software applications in a power plant in Turkey to improve efficiency and productivity, according to the two companies.

GE will install its advanced digital solutions, asset performance management (APM) and operations optimisation (OO) solutions using Predix, the operating system for the Industrial Internet, in Gama's 840 MW İç Anadolu natural gas combined cycle power plant in the city of Kırıkkale. Installation is planned for early 2017 and will help to reduce maintenance costs and improve operational performance.



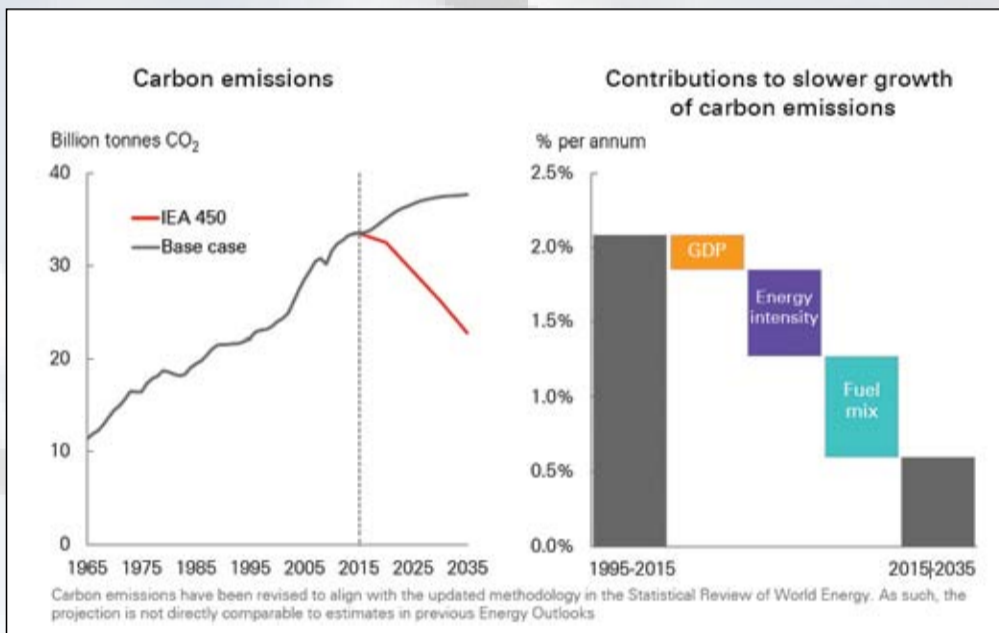
The power sector accounts for an increasing share of energy



For more information, please visit www.bp.com/energyoutlook

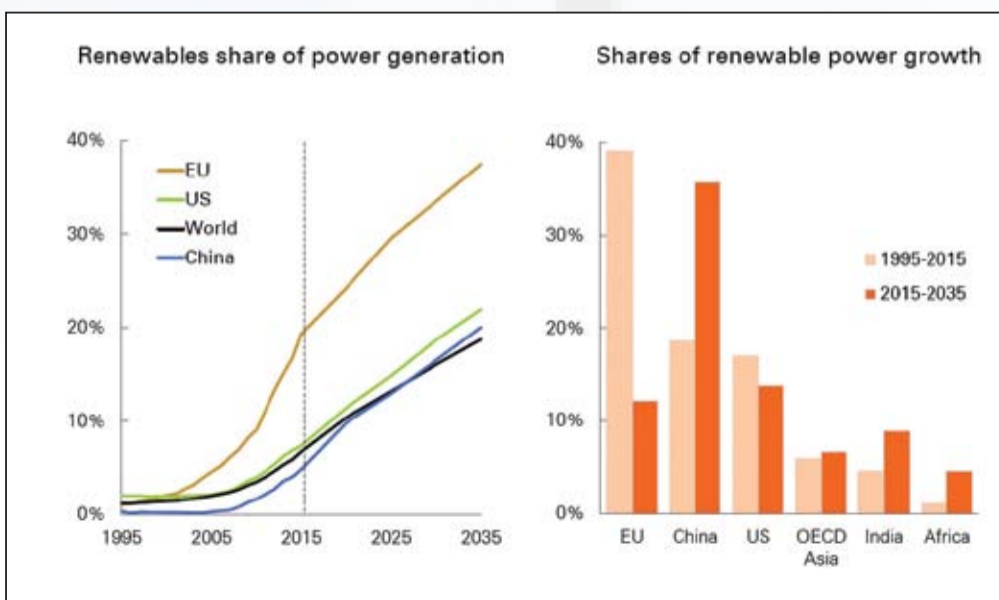
BP Energy Outlook, page 18

Carbon emissions look set to continue to rise



BP Energy Outlook, page 20

Renewables continue to grow rapidly



BP Energy Outlook, page 30

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Oil

Russia output begins to adhere to Opec agreement

- Russia can get to 300 000 b/d by May
- Cutbacks creating opportunities for non-Opec producers

David Gregory

Russia's crude oil production is gradually adhering to the agreement it reached last year with Opec and other non-Opec members, *Interfax* news agency reported in mid-February, referring to a comment made by Russian Energy Minister Alexander Novak.

"We can get to 300 000 b/d at great speed by the end of April. This will allow us in May to produce exactly 300 000 [barrels] less per day than in October [2016]," he said.

At the end of 2016, Russia was pumping a record-breaking 11 million b/d, just before the agreement with Opec and 11 other non-Opec oil producing countries was made with the intention to trim around 1.8 million b/d from global production during the first six months of 2017 with the goal of raising oil prices. By mid-February, Brent crude was trading in the mid-\$50/b range, up by several dollars since the start of the year.

According to a February 10th statement by the International Energy Agency (IEA), Russia decreased its oil

production by 100 000 b/d at the end of January. Moscow said it would make the 300 000 b/d cut gradually, as Novak confirmed to *Interfax*.

Oil producers participating in the cut will look at the results and determine their next move some time after June. According to Igor Yusufov, a former minister of energy for Russia, Moscow will likely continue to work with Opec and maintain an active dialogue with the group in order to stabilise the market. Yusufov, who has also been chairman of Rosneft and a director of Gazprom, told *The Energy Industry Times* that Opec's role as the industry's key production group with the power to influence prices ensures that Russia and Opec will remain engaged in talks on oil production.

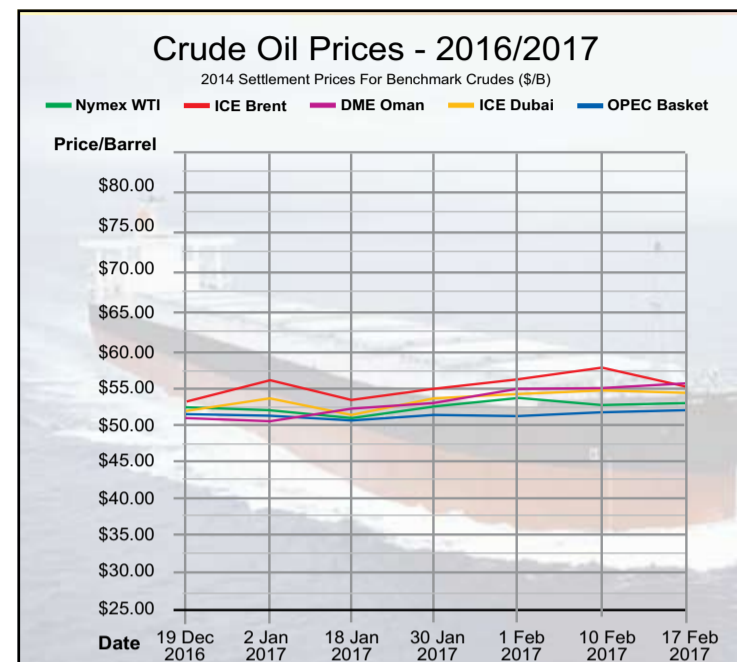
Yusufov noted that Russia and Opec had cooperated before in trimming output in the early 2000s. That effort had succeeded in stabilising the price in the \$21-25/b range, but he declined to speculate on whether the current steps taken to curtail production would result with the price exceeding \$60/b. "The price depends on hundreds of factors, including those of a

political character," he said.

Opec's cutbacks and those by non-Opec producers are creating opportunities for those non-Opec producers who are not part of the agreement, particularly, Brazil, Canada and the US, to pump more oil, encouraged by rising prices. According to the IEA, the combined output of those three countries is expected to increase by 750 000 b/d during 2017. The IEA said the net change for non-Opec production in



Yusufov: price depends on "hundreds of factors"



2017, taking into account cuts by 11 countries, is close to a 400 000 b/d increase – hardly the result that the market is looking for.

US shale oil in particular is coming back strong. How that will impact any decision regarding further cooperation between non-Opec remains to be seen. For US shale, the IEA forecasts that it will grow by an average of 175 000 b/d for 2017 and that output by December 2017 will be 520 000 b/d higher from a year earlier.

Another issue to consider is that Opec members Libya, Nigeria and Iran increased crude output during January 2017. Together, their production increased by 216 700 b/d. According to Opec's latest monthly report, the group produced a total of 32.139 million b/d in January, down by 890 200 b/d from 33 029 million b/d in December. At this rate, it begs the question as to whether this is really going to make an impact on global stocks. According to current IEA estimates, stocks of

crude and products in the OECD countries at the end of 2016 was 286 million barrels above the five-year average and by the end of the first half of 2017, they will still be significantly higher above average levels.

The crude production cutback and subsequent rising prices are problems that Opec knew it had to consider when it took the leap. Any gap in supply will lead to other producers stepping in, but as those producers step in, particularly US shale producers, it might be difficult for Opec and non-Opec producers, especially Saudi Arabia and Russia, to return to the market without putting downward pressure on prices and as a result, returning the market situation to where it was at the end of last year.

This could be why, with the capacity to produce 11 million b/d, Russia agreed to only a gradual cutback of 300 000 b/d, knowing full well that the issue of market share is going to be something that has producers' attention for some time to come.

Gas

Turkey makes progress in meeting natural gas demand

In February, Turkey opened the long-planned gas storage facility at its Salt Lake in Anatolia. It is also making plans to install a second floating storage and regasification unit (FSRU) in anticipation of greater reliance on LNG. The moves will help reduce reliance on Russian gas.

Mark Goetz

Turkey is using about 50 billion cubic metres (bcm) annually of natural gas, yet it produces very little of that amount from its own small resources. The country has gas reserves of about 117 billion cubic feet (bcf) – about 4 bcm – and produced around 14 bcf in 2015, which leaves the country reliant on piped gas supplies predominantly from Russia, which supplies about 60 per cent.

Like countries in East Europe, Turkey would like to reduce its dependence on Russian gas but has recently re-engaged with Moscow on the TurkStream gas pipeline project, which is designed to transport Russian gas across the seabed of the Black Sea and deliver it to the European side of the Bosphorus.

Russia sees TurkStream as a means to bypass its pipeline system through Ukraine, but whether it succeeds in doing this remains to be seen. The plan is to extend TurkStream overland to the Greek border, from where European customers can take delivery of their supplies. So far, only two of the four-string pipeline system are to be built, and one of those, with a 15 bcm/year capacity, is dedicated to Turkey.

Turkey has been aware of its gas supply problem for years, and has been rather slow to address it, but in February it finally managed to open the long-planned gas storage facility at its Salt Lake in Anatolia. It is also making plans to install a second floating storage and regasification unit (FSRU) in anticipation of greater reliance on LNG. As Turkey's demand

for natural gas grows in the years ahead, LNG could play a significant role in Turkey's energy security.

The Lake Tuz Underground Natural Gas Storage Facility was inaugurated in early February with an initial capacity to store 1 bcm of gas and be able to dispense 40 million m³/day into the Turkish gas network. Storage capacity at the facility will eventually increase to more than 5 bcm and daily distribution capacity to 75 million m³.

The World Bank provided loans of around \$700 million towards the construction of the facility, which consists of 12 artificial caverns beneath the salt lake. The facility is operated by Turkey's Petroleum Pipeline Corporation (Botas), whose general director, Burhan Ozcan, said the storage facility will provide energy security for Turkey

and ensure there are no gas shortages for the next two winters.

"We will not have any problems related to energy supply in the next chapter of our country," he told Turkish media during the ceremony marking the opening of the site. He also said that Turkey was looking to install its second FSRU by the end of the year and that it would increase its use of LNG. Currently, about 16 per cent of the country's consumed gas is delivered in the form of LNG through agreements with Qatar, Nigeria and Algeria. It also purchases LNG on the spot market.

Late last year, Turkey chartered the GDF Suez Neptune FSRU through France's Engie and installed the 145 130 m³ vessel at Aliaga, near the existing onshore regasification plant

operated by EzeGaz. The second FSRU will have a capacity to supply 20 million m³/day and be installed either at Saros in Thrace or at Taurus in the Mediterranean. The capacity of the EzeGaz facility is to be expanded from 24 m³/day to 40 m³/day, and the LNG regasification plant at the Marmara Ereğlisi terminal is to increase from 22 m³/day to 27 m³/day.

Turkey also plans to boost the capacity of its gas distribution network over the next five years. The system is to go from the current capacity of 223 m³/day to 400 m³/day during that time. Officials reported that during this winter, daily demand rose to 250 m³/day, which Botas managed to meet. The new storage facility and increased use of LNG should help meet demand, and further expansion can be expected.

Carving out a new vision

Kristian Ruby takes the helm of Eurelectric at a time when the sector is facing unprecedented change. He offers his take on what he sees as the main challenges and provides some insight on his immediate goals.

Junior Isles

As the organisation representing Europe's electric utilities, Eurelectric has had its work cut out in recent years. With electricity demand still sluggish as economies struggle and the transition to renewables in full flow, Europe's electricity sector has not been short of challenges.

On January 1, Kristian Ruby was appointed Secretary General of the organisation, taking over from Hans ten Berge who retired after holding the position for 10 years.

Summarising the last eight or nine years, Ruby said: "The sector has been through a rough patch in a sense. If we take the helicopter view, it's been a combination of things. There's been a drop in demand as a consequence of various legislation and the economic crisis combined with low wholesale power prices, new generating renewable capacity entering the sector, and the issues related to handling variable renewables."

Ruby is familiar with the increasingly green energy landscape. He joins Eurelectric from WindEurope, where he spent two years as chief policy officer, essentially in charge of political strategy. Following a five-year spell as a journalist, he spent around four years in Brussels as assistant to the former European Commissioner for Climate Action, Connie Hedegaard, and before that was a public servant in the Danish Ministries of Climate and Energy as well as Environment. They are the credentials he will need to guide Eurelectric through the changing world and present its views to the European Commission.

While Ruby acknowledges that the new role will be challenging, he says it is the complexity presented by the energy transition that has attracted him to the position. Noting

that utilities are now operating in an industry that is seeing consumers taking a new role in a system where digitalisation is gradually taking hold, he said: "We have to brace ourselves for another decade of disruption."

With significant cost reductions in renewables and "storage entering the market at significant speed", Ruby says new business models will emerge. Indeed, those that can adjust the way they do business are the ones that will take advantage of the opportunities presented by the changing situation.

"What will be key for all players in the sector is to face this future that is coming at us at very high speed and find solutions rather than fight it. Find ways to make money from the new trends and technologies that are coming. Those will be the winners in the sector," said Ruby.

An example he gives is the retail market, where consumers will become more active in not just managing their demand but also participate in energy production. This in turn will change the role of utilities and retailers.

"Some people will say we are going to lose out big-time on this but it's more about the changing role, said Ruby. "Maybe less electricity is going to be produced centrally but energy services will be much more prevalent. With more decentralised generation, the role of aggregator for both supply and demand is a key one for utilities in the future. So it's really about finding opportunities and seeing what the good business models are."

Certainly many companies are already doing this and adjusting their business models accordingly. For example, as part of an effort to take costs out of its operations and improve customer retention, last year

E.On launched the Aura proposition for its German residential electricity customers.

This is an "all-in-one" system comprised of solar, energy storage, an energy management app and a tailored electricity tariff for its customers. The move means that even if E.On lost that customer to its traditional business model, it has not lost that customer to the business.

As the market continues to change, Eurelectric will have an even more important part to play in being the voice of the industry in Brussels. In addition to the ongoing trends, the industry has to face a significant amount of upcoming legislation.

Ruby noted: "We have the ongoing debate on the ETS (European Emissions Trading Scheme) and the Winter Package or the Clean Energy for All Package, as it is called in the Brussels jargon. There will also be a number of new legislative proposals coming on electro-mobility and transport in general that will be of importance to the sector. So the role of Eurelectric is to coordinate industry views and represent the industry at European level."

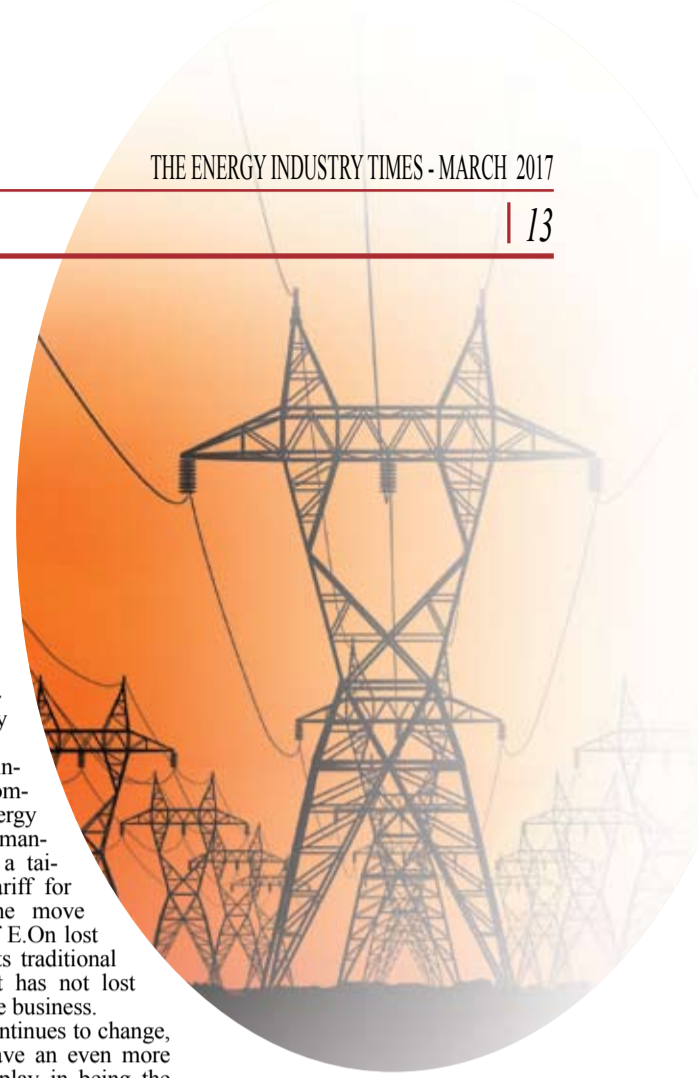
It is fair to say that the electricity sector has been leading the energy transition. It has decarbonised much faster than other sectors, bringing down emissions and providing clean electricity for the transport and thermal sector. Eurelectric has to ensure that the sector continues to do this, while addressing the challenges and exploring what the future utility will look like.

Ruby says he wants to work with the industry on defining a new vision for the sector. "Many companies are discussing how to tackle the challenges and I think it would be a good thing to bring these views together and formulate a common vision of how we would like to position ourselves within this energy transition."

A global challenge going forward and one that is central to the transition, is what should be the main tool for limiting carbon emissions. The ETS has been put forward as Europe's flagship tool but its failure has been well documented. It is widely believed there must be a sensible, global price on carbon if we are to win the climate change battle. However, with the chances of establishing a meaningful global price looking more remote due to the new Washington administration and the issues facing the EU ETS, it will be interesting to see whether emissions trading will remain an important tool in cutting carbon emissions.

"Right now, given the recent reconfigurations of geopolitics, I think it's very difficult to speculate about the global level but my advice to Europe would be to keep calm and carry on," said Ruby.

He does, however, still believe in the potential of emissions trading at the EU level and its ability to improve carbon pricing in Europe. "I think that we have a pragmatic reform of the ETS on the table, which I think we should adopt as soon as



Ruby says DSOs will take "a very central place" in the sector going forward

possible.

"If we increase the uptake of the market stability reserve in a limited number of years to get rid of the structural overhang of allowances, future-proof it by lowering the threshold so that future potential oversupply can be absorbed immediately, and we combine that with a revision of the linear reduction factor to 2.4, I think we will handle the medium term issue of surplus allowances as well as the long term issue of aligning this tool with the EU's overall climate ambition."

The role of Distribution System Operators (DSOs) will also need to be at the heart of debates in Brussels. As the energy system changes, DSOs will be an important part of the link when it comes to connecting and storing distributed energy from renewables and electric vehicles, etc. Ruby says it is important for it to keep an integrated view of the value chain.

"The DSOs will take a very central place in my vision for the sector going forward. We have represented them and will continue to do so in the future. Right now there's an extremely important discussion going on at regulatory level about the future role and representation of the DSOs in Brussels. There is a proposal on [setting up] an entity for the DSOs at EU level. Getting the roles and responsibilities right for this body is a key task for Eurelectric."

One principle that Eurelectric is advocating is that the new body needs to separate lobbying and legislation. "Whereas there may be a need for an independent hand to write certain network codes, etc., it's very important that we don't conflate the roles of representing industry and writing legislation," said Ruby.

In the immediate future, Ruby says his main aim is fulfilling the organisation's "presidential priorities" i.e. mandates related to decarbonisation, electrification, the role of the retailer, empowering consumers, market design and ultimately achieving the energy union. In addition, he reiterated that this year he plans to formulate a new vision that the organisation can build a new strategy on.

Commenting on the longer term he concluded: "Ask me again in three months. Maybe then I will have an idea of what I want to do in five years. For now I have plenty on my plate handling the current legislation, uniting the sector around a new vision and defining a detailed strategy for the next three years."



India will stay on the renewables pathway

Despite concerns that a change in US policy may affect the promises of other nations to lower carbon emissions, for India renewable energy remains key to enabling positive economic and social development.

Bob Smith

With Donald Trump now in the White House there is concern amongst global renewable energy industry and climate change campaigners that the US will renege on its commitment to convert its power to renewable sources. The new President publicly stated during his presidential campaign that the US should not be making climate change a priority, and has been clear about his support for the coal industry. Subsequently, many have begun to worry that other countries may water down their commitments made at the 2015 Paris climate change summit, and particularly those among the developing nations such as China and India.

Despite concerns that a change to US policy may affect the promises of other nations to lower carbon emissions, for India renewable energy remains a major force for good, enabling positive economic and social development. In January this year, India's Energy Minister, Piyush Goyal, reaffirmed India's commitment to renewables when he was asked if Donald Trump's negative stance on global warming would influence India to change its plans of becoming a global hub for renewable energy.

There is a thirst for power coming from the rapidly expanding towns and cities across India. However, power outages are a daily occurrence, and large buildings such as factories and hotels require diesel-powered generators just to keep the lights on.

India needs to keep pace with rapidly growing demand for energy, and this is where renewables are coming into their own.

While the western world is moving away from fossil fuels primarily for environmental reasons, in India wind and solar has become both the quickest to market and the most flexible to implement, whilst also meeting clean energy requirements. Critically, renewable power in India is cost-competitive with coal generation, and so does not need a subsidy to be viable. It's a win-win situation.

A coal power station can take five years to build and bring into operation, whilst a 100 MW wind farm can be planned, installed and attached to the grid in just two years. In six years Mytrah Energy has gone from a start-up with no assets to amassing a 1 GW wind portfolio, spanning 16 locations across the length of India. These assets produce enough energy to power millions of Indian homes – a significant output but only a fraction of what is demanded.

In 2015, the Indian government unveiled its ambition to build 175 GW of renewable energy capacity by 2022, an ambition ratified by Prime Minister Modi at the Paris climate conference. This will be split between 100 GW solar, 60 GW wind, 10 GW biomass and 5 GW of small hydro-power. Towards the end of 2016, the Central Electricity Authority (CEA), an Indian federal statutory body, published its draft national electricity plan, stating that non-fossil fuels are expected to meet 56.5 per cent of India's electricity requirement by the end of 2026-27, equating to 275 GW. This won't be easy to achieve, yet it demonstrates that India is absolutely committed to renewable energy targets and clean energy growth.

For India's independent power producers, like Mytrah, the task has been laid out and as a collective we are moving rapidly to build our respective energy portfolios. Mytrah currently has an additional 3000 MW of wind power in planning and construction and, as the business looks to diversify its revenue streams, is well on its way to completing its first solar assets.

With the monsoon season bringing strong winds, and an above average number of sunshine hours per year, India is one of the most opportunistic renewable energy markets in the world. The sector is also not subsidised, making it more competitive and thus more attractive to operate in: it costs half as much to install a wind turbine on land in India as it does in the UK where the government must still grapple with subsidies and the consequential pricing effects. In India the unit price of wind and solar power is now close to parity with that of traditional carbon-based

power. This is certainly not the case in the UK and even more so when generating power offshore.

All of this presents significant commercial opportunities for investors – both domestic and foreign. India's energy sector is, and will remain, reliant on major foreign investment to reach its goals and it is essential that India continues to attract investment into its power infrastructure. It was forecast that \$200 billion would be required to meet the Indian government's original 175 GW target; a target which would be heavily reliant on foreign investment.

However, with Indian renewable energy capable of delivering EBITDA margins at over 90 per cent, and long-term power purchase agreements in place with state governments, the sector is very attractive to large institutions in search of both capital growth and yield.

The Indian government and private sector have come a long way to make India an increasingly more attractive destination for investors. According to a 2016 report by fDi Intelligence, India became the top destination for direct foreign investment, with \$63 billion coming into the country during 2015, overtaking China. We are all fully aware that progress needs to continue and although occasional delays in power purchase payments by some Indian state utilities have generated headlines, the government has moved rapidly to resolve these issues. As new initiatives take hold, the utilities are strengthening, reducing the risk of such episodes in the future.

This global influx of renewable investment is reverberating locally, with even the Indian fossil-dominated utility industries getting in on the action. Two big oil companies, Indian Oil Corp. and Oil India, have begun permitting a 1 GW solar farm in Madhya Pradesh, according to the state agency. Meanwhile, India's largest coal fired electric utilities, Tata Power and NTPC, are competing to become the biggest players in developing renewable energy.

Without question, renewable energy is becoming more competitive, which means the players in the space need to continue to invest and innovate to stay ahead of the pack. Regarding wind power specifically, the hub heights and rotor diameters of wind projects have increased substantially in the last two decades, while the average wind turbine output increased by almost ten-fold. By boosting the level of energy generated per turbine, the overall cost of electricity is reducing. With the use of lightweight materials such as carbon-fibre, better aerodynamic profiles, on-site manufacturing, segmented blades and variable diameter rotors, costs are

expected to come down further, while pushing the capacity factor. A US Department of Education study suggests that adoption of advanced technologies can increase energy output to the tune of up to 61 per cent, while requiring much smaller increases in capital cost.

New technology is also bringing down the cost of solar power. While this is good news, the solar auctions run by individual Indian state governments have become increasingly competitive.

According to Bloomberg, in 2010 the lowest solar tariff in India was Rs10.95 per kilowatt-hour (\$0.16/kWh). At the end of 2016 that had fallen to Rs4.34 per kilowatt-hour (\$0.064/kWh), which has led to concern that some projects will not be viable. These projects rely heavily on bank financing and the banks are now examining very carefully whether some solar projects carry too much risk at super low prices. The over-exuberance by some companies to win the auctions is not unique to India, but the high-profile bankruptcy of US firm SunEdison, which bid for \$3 billion of Indian solar projects, has led to India's solar power industry being put under the spotlight.

Mytrah Energy has maintained a conservative approach to the solar auctions it has participated in, winning with strong tariffs that deliver good economics. Last year we secured power purchase agreements for 422 MW of solar to be built across three states, with our first solar projects set to be fully operational this year. The economics must make sense if we are to both deliver power at competitive prices but also be commercially viable and build enterprise value. This is also true of wind. The industry is learning fast and recognises that the pricing must be right if we are collectively to deliver on India's renewable energy ambitions. The good thing about a free market is that it will adapt accordingly.

India is at the forefront of renewable energy development. For any economy looking to cement its long-term future, whether established or developing, renewable energy needs to be centre stage right now. The world should be concerned about anti-renewable rhetoric, but the likes of India and China won't be changing course regardless of other countries' political processes, because these countries know that the continued growth of renewable energy infrastructure will build better economies. For Mytrah Energy, renewable power is certainly the most exciting industry to be part of right now.

Bob Smith is Executive Vice President, Mytrah Energy Limited



Smith: India and China won't be changing course regardless of other countries' political processes

Powerful predictions

Predicting energy demand is key for planning the development of entire economies but getting it right is not straightforward. **Junior Isles** hears about a cutting-edge project that could go some way to delivering greater accuracy.

Accurately predicting future energy demand is crucial, not only for planning new generation but also for predicting carbon emissions. Existing forecasting methods and tools, however, tend to be static as opposed to dynamic i.e. they do not take into account the development of households. But a pioneering project looks set to change that.

Nottingham Trent University in the United Kingdom has developed a tool that brings a lot more accuracy to predicting energy demand with the development of a forecasting tool that can predict an individual's or an entire city's energy needs ten years in advance.

Moulay Larbi Chalal, a PhD candidate at the university, used data from more than 6000 households over a 17-year period to monitor how people's requirements for gas and electricity evolve over the course of a lifetime.

Professor Benachir Medjdoub, a professor of digital architectural design at Nottingham Trent University, who supervised the project, explained the development of the new tool.

"A couple of years ago, we did a lot of work in energy simulation, taking into account building physics – we can always simulate the energy use of a building based on its physical characteristics. If you say you want to heat an empty building to a certain temperature, that works well. But if you put someone in the building, the prediction is never accurate.

"Research showed that energy use is very dependent on human behaviour... criteria such as culture, income, level of education, etc., can alter energy use. This led me to the idea to see if we could use big data based on family characteristics [to predict energy use]."

The project set out to build a tool that could see how a family was likely to develop in the long term and how the corresponding energy use changes over time.

Professor Medjdoub noted: "While there has been a lot of research looking at human behaviour and energy, I haven't seen any research that takes into account the [household] transition."

The forecasting tool used data taken

from the British Household Panel Survey and was developed in collaboration with Nottingham Energy Partnership. According to Professor Medjdoub, the system is unlike anything used today.

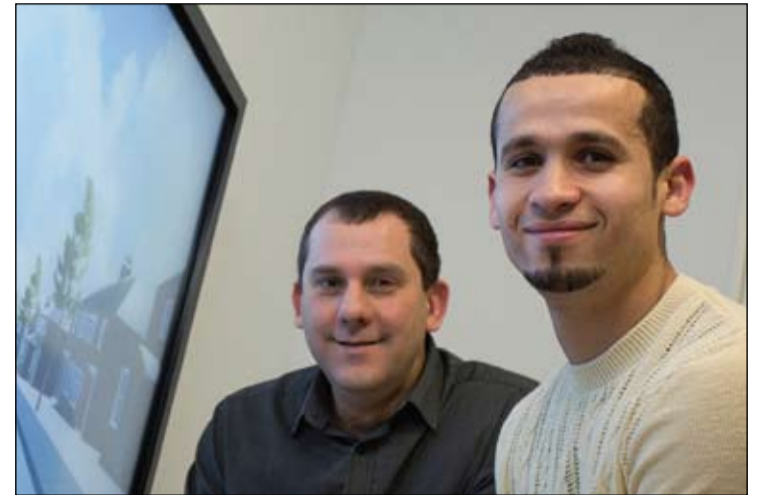
"We had all the data about the families," noted Professor Medjdoub, "including income, electricity and gas bills, how the family changed – going from a couple to a family with one child, etc. It was very accurate and collected over a long period of time. We then thought we would analyse the data to see if we could extract a pattern, which showed us how the family changed over the time along with their energy use. For example, we could have a couple and see the probability of that couple becoming a family with one child in 10 years time and, based on parameters like income, determine their energy use."

The modelling revealed some interesting findings. For example, the tool shows that the average single, non-elderly person has almost a 20 per cent chance of finding a partner and moving in with that partner within five years. Of those newfound couples, 53 per cent will go on to have a child during the same period.

Probable future energy needs can then be calculated based on this data. For instance, around 26 per cent of those couples without children will use more than 4000 kWh of electricity per year, while the same amount of energy will be used by as many as 35 per cent of couples with children. A key finding was that there is a substantial increase in energy use when children are involved.

The tool was benchmarked in the Sneinton area in Nottingham. The research has taken into account 500 homes, mainly council houses. "The advantage of working with councils and the houses they manage is that they have the data. The tool will be very useful for predicting energy use for those neighbourhoods for the next few years; it's very important for energy planning," said Professor Medjdoub.

Although the tool was benchmarked for 500 households, it is possible to use it for larger neighbourhoods. Professor Medjdoub notes, however, that going much larger will have its challenges. "We



Moulay (right) and Professor Benachir Medjdoub: energy use is very dependent on human behaviour

haven't benchmarked it for a city in one go. I suspect it would provide some results but I see it being much more reliable at a neighbourhood level. So we could go neighbourhood-by-neighbourhood."

With much larger areas being a goal, Professor Medjdoub said an interface is now being developed using 3D gaming technology. This presents a 3D model of Sneinton running on Unity 3D. The first mathematical model has been implemented of a specific type of family transition. This has been run for one neighbourhood.

Professor Medjdoub explained: "There is a certain processing time. If we do it for a city, we will do it sequentially where we divide up the city and run it neighbourhood after neighbourhood. We would also take into account the zoning of energy supply to see if a specific supply can be enough for a particular zone. I think doing it by zoning a city will work quite well."

Nottingham Trent University says the ability for cities to monitor and predict energy use, also enables them to calculate their carbon footprint. "Once you know the energy source, it should not be a problem calculating carbon footprint from the amount of energy used," said Professor Medjdoub.

There is no doubt that such a tool will be extremely useful to planners such as the City of Nottingham,

Nottingham Energy Partnership and energy suppliers, who want more accuracy in predicting energy consumption. How extensively it can be deployed clearly depends on the amount and quality of data that is available.

"The same methodology can be used in other countries but obviously we need their data to get probability of change, said Professor Medjdoub. "They need to have data over quite a long term. The likes of Germany has some data but for other countries that don't, it will be difficult."

In the meantime, Professor Medjdoub and his team are continuing with developing the user interface and plan to complete all work on the system in June this year. At the same time the University will gauge interest in executing similar projects with other energy providers.

While energy demand in the household sector is a significant part of overall energy demand – representing more than a quarter of the UK's gas and electricity and responsible for around 20 per cent of total carbon dioxide emissions – there are currently no plans to extend research to industrial and commercial sectors. It's a case of one step at a time,

Professor Medjdoub mused: "The problem of industrial and offices, etc, is completely different."

Sounds like research for a subsequent PhD project.

McKinsey Energy Insights launches energy demand tool

One of the main drivers behind the need for better energy forecasting tools is the ongoing energy transition. Notably, McKinsey Energy Insights (MEI), the analytics specialist, recently launched its Energy Demand Intelligence (EDI) Community tool.

The innovative platform – which offers access to McKinsey's latest data and insights online – enables organisations to forecast primary and final energy demand (after transmission and distribution) and CO₂ emissions based on MEI business-as-usual scenario and variables for specific regions, fuels or sectors. This platform – which includes featured insights – is designed to enable companies to instantly access data and quickly build analyses to make more informed decisions about their business.

Christer Tryggstad, a Senior Partner with McKinsey & Company, leading the Knowledge Committee of the European Electric Power and Natural Gas (EPNG) Practice and McKinsey's Scandinavian Energy Sector explained the need for the tool. He said: "Many of our clients have been pondering how to make the best investments for the future during this transition. When we look back at [other] big transitions or disruptions like this, we have seen that there are companies that have managed to create value and some that haven't. So far in the energy transition, it has proven to be relatively hard to create a lot of value."

The tool is essentially a set of interlinked energy demand models for several different segments, i.e. industry, transport, buildings and power, which are again divided into sub-sectors.

The power segment addresses primary energy consumption as well as final energy demand i.e. the power consumed across all sectors. MEI notes that this segment is particularly interesting since power as a source of final energy demand is growing more rapidly than energy demand in total.

"There is a big electrification trend going on," said Tryggstad. "While energy demand in total is growing at around 0.6-0.7 per cent per year on average, total power demand is growing more than 2.5 times as fast."

Power is therefore the segment that MEI is working most intensively on at the moment. "It's a pretty big task, which we're in the middle of and it will be another 4-6 months before we have the next level power model," said Tryggstad.

The power segment will include a large number of country models that can be run independently, while accounting for the links between markets. MEI says it will ultimately have "north of 150" country models.

Bram Smeets, a Solution Manager at MEI leads the team developing the forecasting tool. He added: "At the country level, we want to offer the ability to see the key forces shaping the energy transition, the demand outlook and how it will evolve. We will eventually have a global perspective but will start with 20 key countries that have the lion's share of global demand."

An initial version of the overall energy demand model is already freely available on the Internet, while a more advanced paid-for model, offering increased granularity and flexibility, will be released in the coming months.



Junior Isles

Stop flogging a dead horse

The United Kingdom's nuclear new build programme is cursed, or so it seems. It took a decade of development and torturous negotiations before Hinkley C was finally given the go ahead. And even then, the steep price of power from the plant and eye-watering government guarantee make it a bad deal for consumers. Now, with Toshiba in meltdown, the proposed project at Moorside is in serious jeopardy and will likely need yet another government guarantee to proceed.

While saying Britain's plans to build 16 GW of new nuclear power stations by the mid 2020s is in disarray would border on exaggeration, it would not be far off the truth. Aside from the fact that there is no chance that any of the projects will be operational by the middle of the next decade, their financial viability becomes increasingly questionable.

The status of the six proposed plants is not encouraging. Although the green light has been given for Hinkley, potential obstacles remain especially when considering the financial challenges facing lead project developer EDF. Moorside is in trouble and Hitachi is locked in talks with the Japanese and UK governments in an effort to secure state aid for Wylfa. Meanwhile proposals for reactors at three other sites are at such an early stage, it is highly likely that these will all face similar problems when considering the expected price tags.

On top of that, companies vying to build nuclear power stations in the UK have been told they must offer a price for their electricity that is at least 15-20 per cent lower than that approved for the Hinkley Point plant last year.

But it is not just the UK's programme that is beset with misfortune. The

capital cost of the new generation of large-scale nuclear projects and the impact on their financial viability is without doubt the Achilles heel of the industry globally going forward. Certainly developing these 'Generation III+' projects is not for the faint-hearted and is a challenge even for companies with huge balance sheets.

Time and again we have seen the estimated costs of these latest generation projects spiral. Like Hinkley, the setbacks with Areva's EPR reactors being built at Olkiluoto in Finland and Flamenville in France have been well documented. Now Toshiba is facing a similar story in the US.

Westinghouse, Toshiba's US-based nuclear engineering subsidiary, is building two of its new AP1000 reactors at Vogtle. These are intended to be the flagship of its expansion into markets around the world. Two more are being built in South Carolina at the VC Summer site.

The projects are several years behind schedule and, on a combined basis, more than \$10 billion over their original budgets. This cost escalation was at the heart of Toshiba's announcement that it will book a \$6.3 billion hit to its US nuclear unit. It is now considering its options, which include selling Westinghouse.

Unfortunately, the situation facing Vogtle, Olkiluoto *et al.*, are not tales of the unexpected. For decades nuclear new build programmes have been plagued by huge cost and time overruns. Nuclear proponents will rightly argue that going over budget and behind schedule is not specific to nuclear but is a characteristic of most large infrastructure projects.

Yet that is not reason enough in itself to persist with a technology when there are options. Perhaps it is time

to stop flogging a dead horse. Nuclear power is a mature technology and if large projects cannot be built without state aid or potentially bankrupting the developer, maybe it is time to throw in the towel and focus on the alternatives.

First and foremost, any other option must be low or no carbon. This is imperative if countries are to adhere to their climate change commitments.

Renewables advocates point to the growing financial competitiveness of wind and solar as added reason for green energy to take centre stage. Certainly the cost of solar has fallen dramatically over the last decade. Today solar is the lowest-cost power in many regions of the world.

Meanwhile even the price of electricity from offshore wind has fallen more rapidly than expected and is already significantly lower than the price that will be paid for power from Hinkley C. According to a report on schemes built by Dong Energy and other developers the cost of electricity from projects in the UK plummeted by nearly a third in four years to an average of £97/MWh during 2015-16. In 2012 the British government set a target to drive costs down to £100/MWh by 2020.

Impressive cost reduction combined with government support has seen solar and wind grow at phenomenal speed, a trend that looks set to continue. According to BP's latest Energy Outlook to 2035, renewables in power are expected to grow at an average rate of 7.6 per cent per year on the back of the increasing competitiveness of solar and wind. Solar is forecast to rise more than eight-fold and wind more than four-fold over the outlook period.

According to a recent McKinsey Global Institute report, renewable

energies including solar and wind will become cheaper and more competitive with fossil fuels, and play a substantially larger role in the global economy's energy mix. Renewables could grow from 4 per cent of power generation today to as much as 36 per cent of global electricity supply by 2035, it says.

Yet such impressive growth will not be sufficient to meet climate goals. Further, low carbon base load generation will still be needed – even with the rapid growth in energy storage, which is needed to optimise the integration of intermittent renewables.

Widespread switching from coal to gas is the obvious option for the rapid addition of cheap, new, base load generation, which does not need subsidies. There is also a worldwide abundance of gas and supply is becoming increasingly diverse.

Yet the attraction of nuclear remains. In addition to being a base load zero carbon form of generation, it offers very low running costs and can give countries energy security by eliminating dependency on fossil fuel resources from abroad.

So if governments are hell-bent on keeping nuclear in the future energy mix, perhaps they should stick with tried and tested technology as they have in the United Arab Emirates and at Finland's new Hanhikivi 1 plant. These projects are progressing smoothly.

Alternatively they could invest more effort into accelerating the development and deployment of small modular nuclear reactors (SMRs).

The 'Lloyd's Register Technology Radar – Low Carbon', published in February, commented on the potential for SMRs in the UK. The report, which examines the outlook for renewables, nuclear, grid and infrastructure, and energy storage, sought the insights and opinions of leaders across the electricity sector, as well as the views of almost 600 professionals and experts around the world.

The survey respondents said that SMRs will only be seen in the medium term, have a low likelihood of eventual take-up, and will have a low impact when they arrive. According to Tom Greatrex, Chief Executive of the Nuclear Industry Association and former shadow energy minister in the UK, however, this is not stopping governments from investigating their potential.

"SMR technology could potentially provide flexible low carbon generation, which would complement base load from larger nuclear plants. There is a very strong interest in the technology being shown right now and the UK government is running a competition, which might have a quite significant impact in the medium term."

It is an interesting statement – one that clearly shows that despite the huge challenge facing the UK's nuclear new build plan, Greatrex, like many of his former government colleagues, still believes in the case for a new generation of large-scale nuclear plants.

In the changing energy landscape, such dogged persistence no longer makes sense. Perhaps they and others around the world considering new generation designs would do better to follow the advice of comedian and movie actor W. C. Fields who once said: "If at first you don't succeed, try, try again. Then quit. There's no need to be a damn fool about it."

