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Obstacles remain following Bonn climate talks

With the UN Climate Change Conference just weeks away, climate negotiators are still struggling with many of the same disputes that have dogged progress from the outset. **Junior Isles**

The last round of negotiations, which recently concluded in Bonn, Germany, has left world leaders with significant obstacles to overcome at crunch climate change talks to be held in Paris in December.

With the UN's Conference of the Parties 21st (COP21) climate summit just weeks away, talks in Bonn ended with no resolution over the same issues that have dogged talks for years.

Once again, finance was one of the main bones of contention. Poor countries insist wealthy countries should shoulder most of the burden for cutting greenhouse gases, as they were responsible for producing it in the first place.

A shortened version of the negotiating text for COP21 released in early October aggravated the situation. At just 20 pages it was less than a quarter of the length of the previous 89-page document, which negotiators had been using.

Developing countries argued that the shortened text ignored the views of poorer countries, failing to include more detailed measures to help poor nations deal with the loss and damage caused by global warming.

Xolisa Ngwadla, lead negotiator for the Africa Group, said the 20-page draft text was "unbalanced" and "crossed the group's red lines".

Following fraught negotiations, a lengthier updated text was produced in an attempt to appease developing countries over the lack of financial detail in the deal. The new document now contains more detail on issues such as equity and decarbonisation, originally axed in the revision process.

But with the meeting again running overtime and the final negotiating text ballooning to 55 pages, there are fears that Paris will not deliver a strong global agreement.

At the conclusion of Bonn, Laurence Tubiana, France's climate ambassador, said she was disappointed the meeting ended without any real negotiating taking place. "We have no Plan B", she told the meeting's closing session, warning delegates they should be prepared to work hard from day one in Paris.

Other observers noted that there was progress but agreed it would not be easy to reach a strong agreement in Paris.

Jennifer Morgan, Global Director,

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Banks announce increased climate funding ahead of COP21

Several announcements on climate financing last month could help smooth efforts to reach a strong global agreement on climate change in Paris in December.

Finance is central to the success of an agreement, as poorer countries say they will need funds to adapt to future extreme weather events, funds to mitigate carbon emissions by using clean energy and funds to invest in early weather warning systems.

The European Investment Bank (EIB), the world's largest lender for climate related projects, will increase the proportion of its lending in support of climate related investment in developing countries from 25 to 35 per cent.

Speaking at a meeting of finance Ministers and multilateral financial institutions at the IMF – World Bank annual meetings in Lima, Werner Hoyer confirmed that the EIB will increase climate lending in countries identified by the UNFCCC and the OECD as being especially vulnerable to the adverse impacts of climate change.

"The EU Bank will provide well over $110 billion for climate action projects around the world over the next five years.

We must do all we can to unlock new investment in countries especially vulnerable to climate change... The EIB now expects its lending for climate projects to represent over a third of its support in those countries", said Werner Hoyer, President of the European Investment Bank Group.

At the Lima meeting, the world's leading development banks promised to boost climate finance and said they would commit $100 billion a year to developing countries by 2020. French Foreign Minister Laurent Fabius said: "This is a positive outcome and I think we can say with some certainty that we will reach the $100 billion commitment."

The World Bank said it will boost climate financing by a third, making $29 billion a year in additional funding available by 2020.

Asian Development Bank (ADB) President Takehiko Nakao said the ADB's annual climate financing will increase to $6 billion by 2020, up from the current $3 billion. ADB's spending on tackling climate change will rise to around 30 per cent of its overall financing by the end of this decade.

Out of the $6 billion, $4 billion will be dedicated to mitigation through scaling up support for renewable energy, energy efficiency, sustainable transport, and building smart cities. The other $2 billion will be for adaptation through more resilient infrastructure, climate-smart agriculture, and better preparation for climate-related disasters.

The African Development Bank pledged to triple its spending on climate change mitigation and adaptation projects to nearly $5 billion a year by 2020.

Countries including Germany, France, the Netherlands, the United States, Sweden and Britain have also recently announced increased climate finance.

A report issued by the Organization for Economic Co-operation and Development (OECD) found that spending on climate projects was up from $52 billion in 2013 to $62 billion last year with multilateral development banks making up about 40 per cent.

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Climate Program, World Resources Institute said: "Negotiators made some significant strides here in Bonn but a much more vigorous pace is needed to secure a strong climate agreement in just a few weeks… negotiators took full ownership over crafting the draft agreement, which demonstrates their strong commitment to a successful outcome in Paris. This determination needs to continue at all levels to connect the dots between the negotiations and the ministerial gatherings ahead of COP 21.

"The current state of the draft agreement reflects how close countries are to reaching consensus on key topics. For example, progress was made on mitigation and transparency where negotiators are now debating the details, while on adaptation and finance there remain more fundamental differences."

Meyer noted "substantial progress on some issues"

Alden Meyer of the Union of Concerned Scientists in the US commented: "There was substantial progress on some issues," adding "it should be remembered that more than 150 countries have tabled voluntary plans to tackle climate change as part of the talks."

These voluntary plans, however, will be another key point in any global agreement. The Intended Nationally Determined Contributions (INDCs) submitted to the UN fall short of what is needed to keep global warming below the 2°C level agreed in Copenhagen.

According to the WWF, addressing the emissions gap will be one of the first big jobs facing leaders when they arrive in Paris.

Dr Stephen Cornelius WWF-UK's chief advisor on climate change said: "While these pledges are a start in taking climate action, we know that we are still on course for a world which will heat up above 2°C.

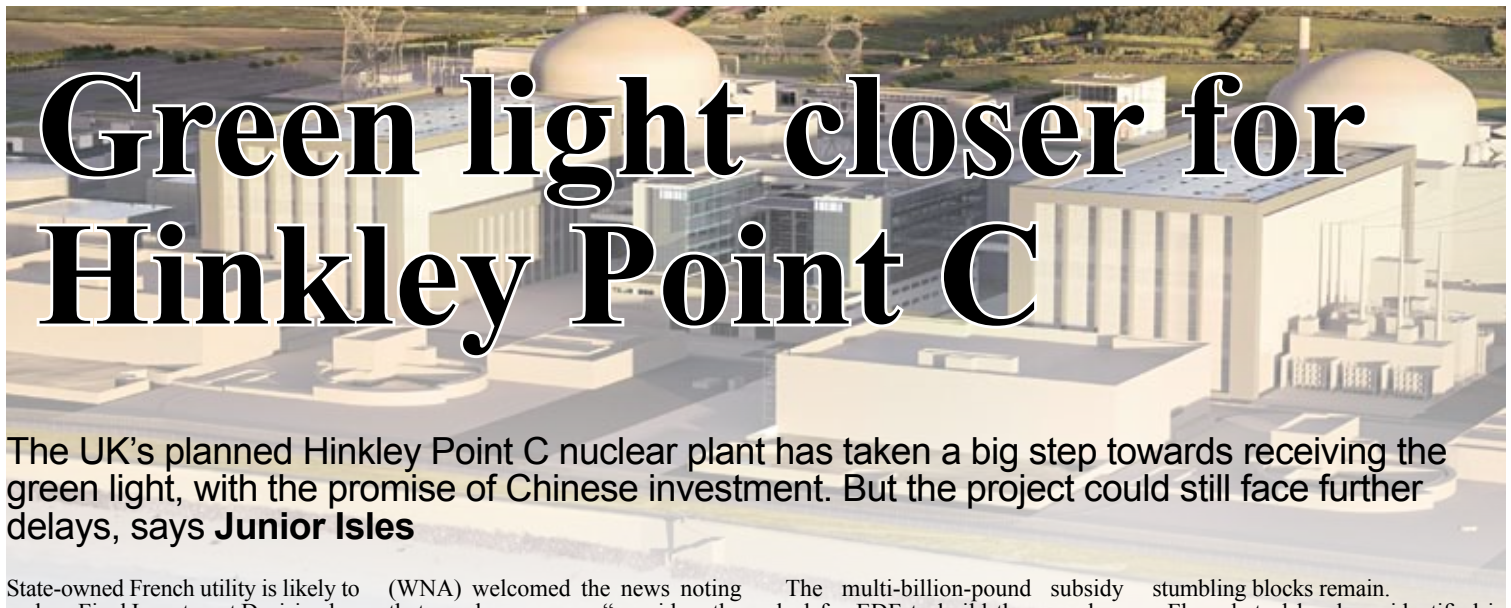
"The Paris climate deal must include ways to encourage countries to take on tougher emissions targets. These targets must be fair and fit the scientific evidence in order to avoid the worst impacts of climate change."

The WWF says the new climate regime and the ambition mechanism must be built around regular five-year cycles of progressively more ambitious contributions, informed by science and equity reviews.

Tasneem Essop, WWF's head of delegation to the UNFCCC commented: "Leaders must deliver an agreement that allows for a regular increase of climate action. An ambition mechanism will enable this.

"If this is not agreed, we are at risk of a climate deal where countries offer commitments purely based on their 'national circumstance' with little or no consideration to the requirements of science or fairness."

■ Professor Hoesung Lee of South Korea has been elected as the new head of the Intergovernmental Panel on Climate Change (IPCC), the UN body tasked with assessing climate science. Lee will replace Rajendra Pachauri, who stepped down in February this year after a 13-year tenure.



Green light closer for Hinkley Point C

The UK's planned Hinkley Point C nuclear plant has taken a big step towards receiving the green light, with the promise of Chinese investment. But the project could still face further delays, says **Junior Isles**

State-owned French utility is likely to make a Final Investment Decision before the end of the year on the UK's new Hinkley Point C nuclear power station. The project, which is expected to be fully operational in 2025, eight years later than originally planned, finally looks set to go ahead following China's decision to take a 33.5 per cent stake in the controversial project.

Senior EDF executives and a negotiating team led by China's state-owned China General Nuclear Corporation (CGN) signed an agreement just hours before the arrival of President Xi Jinping of China in London. The deal will see China provide £6 billion of the project cost, which EDF puts at £18 billion. EDF will lead the project and fund the rest of the construction bill. The European Commission has previously estimated the cost at £24.5 billion, including financing costs during construction.

EDF is expected to sell €10 billion of assets over the coming five years as it shores up its balance sheet and prepares to build up to three nuclear projects in the UK with its Chinese partners.

The World Nuclear Association (WNA) welcomed the news noting that nuclear power "provides the stable foundation" to support other climate-friendly technologies.

WNA Director General Agneta Rising said: "… we need to see more countries learning from the UK's example to support nuclear energy among a mix of generation technologies that are fit for the future. Governments must act to ensure that markets support new investment in technologies such as nuclear, the UK is showing one way this can be achieved."

Government support for what is a mature technology has, however, seen Hinkley C come in for heavy criticism. While cutting subsidies for renewables, the government is guaranteeing a fixed price for energy from nuclear plants, so companies have the certainty to invest in the sector.

This comes at a high cost in the future for UK consumers who, in today's money, will pay a guaranteed £92.50/MWhr for 35 years to repay the money invested by the Chinese and EDF. This is about twice the current level paid today and higher than similar contracts for other low carbon energy such as onshore wind.

The multi-billion-pound subsidy deal for EDF to build three nuclear plants at Hinkley, Sizewell, and Bradwell will add an estimated £33 a year to the average UK household bill for over three decades, according to new analysis by Greenpeace's Energydesk.

Professor David Elmes, head of the Global Energy Research Network at Warwick Business School, said: "The government's argument that cutting subsidies for solar and wind today so as "to keep bills as low as possible for hard-working families and businesses" is hard to square up with signing deals that commit those same families and businesses to high prices for decades into the future."

Barbara Stoll, Greenpeace UK energy campaigner, said: "It appears that there is one rule for renewables and one rule for nuclear. The Energy Minister was clear that the subsidies for the nuclear industry can last for 30 years, yet she's expecting the solar sector to be subsidy free almost immediately."

Although Chinese investment is a massive boost for the project, much remains to be negotiated and potential stumbling blocks remain.

Flawed steel has been identified in the reactor pressure vessel of an identical nuclear reactor being built in Flamanville in Normandy, France. Work might not start at Hinkley Point until these issues are resolved.

Due to financial difficulties and huge levels of debt, the French government has commenced a restructuring of EDF and Areva NP into a merged company, which could lead to further delays.

Also, a legal challenge to the European Commission by the Austrian and Luxembourg governments, and a group of Austrian and German renewable energy companies, over its approval of the UK's state aid deal for Hinkley Point could still jeopardise the project.

Roy Pumfrey, spokesperson for the Stop Hinkley Campaign, also noted: "… the Chinese are not willing to invest as much as EDF wanted; so there is a £10 billion black hole in the finances and there is still no signed contract with the UK government."

■ EDF has formally asked the French government for a three-year delay until 2020 to the deadline for startup of its Flamanville EPR project.

Support for carbon pricing

Business leaders have welcomed the recognition of carbon pricing as an important tool to tackle climate change in the UNFCCC's draft negotiating climate change text released in Bonn in late October.

Nigel Topping, CEO of We Mean Business said: "Putting a meaningful price on carbon is one of the most effective policy measures to drive the transformation of global energy systems. To date 39 countries and 23 cities, states and regions are putting a price on carbon through taxes or cap and trade systems and many more plan to do so in the next few years."

Days before the conclusion of the Bonn meeting, world leaders, as well as heads of cities and corporations, had issued a joint statement urging governments and businesses to set up carbon markets and tax carbon emissions ahead of climate talks in Paris in December.

The call to price carbon came from the Carbon Pricing Panel – a group convened by World Bank Group President Jim Yong Kim and IMF Managing Director Christine Lagarde – to spur further, faster action ahead of the Paris climate talks.

The Panel's statement was prompted by an earlier draft of the negotiating text to be approved in Paris that excluded language on carbon pricing because some countries are opposed to the use of markets to address climate change.

In response to the Carbon Pricing Panel announcement, Nicolette Bartlett, Prince of Wales's Corporate Leaders' Group said: "Business has been supportive of a carbon price for a long time. Clearly this is happening at a national and regional level at the moment and to create a level playing field, the ultimate aim should be for us to be able to realise a global carbon price in the future."

Damien Morris, Head of Policy at Sandbag welcomed called for global carbon pricing but added a word of caution. "The example of the EU Emissions Trading Scheme shows that the design of any pricing scheme must be carefully thought through. After a decade, the ETS has failed to drive the emissions cuts needed, and flounders at € 8 per tonne of CO_2," he said.

Others, however, went further. In response to Shell's call to support carbon pricing at a recent conference, Greenpeace's Charlie Kronick said: "Carbon pricing is a costly distraction from meaningful action on emissions. While it appears progressive, the devil is in the detail."

Coal "caught in a perfect storm"

A new report from WWF says coal is caught in a perfect storm, with concerns about climate change, the environment, and health impacts increasingly inciting governments to impose regulations on its use.

The financial sector in many parts of the world is moving rapidly away from coal, said the WWF. Major institutional investors such as AXA, Aviva, California's state pension funds, the city of Oslo's pension funds and the Norwegian Sovereign Wealth Fund are divesting away from coal.

According to a recent report in the *Financial Times*, nearly $1 billion has been wiped off the value of coal investments by UK public pension funds over the past 18 months, intensifying pressure on the schemes to pull out of "stranded" fossil fuel companies.

Banks such as Credit Agricole and Bank of America are also reducing their lending to coal. Citigroup recently released a new policy to cut its lending to the global coal mining industry. The bank updated its environmental and social policy framework, stating that it had begun to cut its credit exposure to coal mining.

Samantha Smith, leader of WWF's Global Climate and Energy Initiative said: "Increasingly governments and financial institutions are turning their backs on coal and the industry is in decline. Wealthier governments should put their efforts into financing a rapid and just transition into renewable energy and energy efficiency."

Late October saw the publication of the first ever assessment on progress towards ending reliance on coal power across the G7. The USA comes top in the ranking, leading a clear move away from coal evident across all G7 members with one exception. Japan is ranked last in seventh place, standing in isolation, with more than 27 GW of additional coal power capacity planned.

The analysis and accompanying scorecard produced by environmental think tank E3G, with the support of Kiko Network and Natural Resource Defense Council, was launched at UN climate talks in Bonn.

California implements step-change in renewables drive

California is once again leading the way in clean energy targets after Gov. Brown signed a new law to boost renewables, energy efficiency, and drive the uptake of electric vehicles in the state.

Siân Crampsie

California is set to double its use of renewable energy after Governor Jerry Brown signed a new law aimed at reducing pollution and cutting carbon emissions.

The new legal mandate – SB 350 – sets the most aggressive greenhouse gas emissions and renewable energy benchmark in North America and commits the state to generating half of its electricity from renewable energy sources by 2030.

The law also mandates California to make its existing buildings twice as energy efficient, and also directs the electricity industry to deploy charging stations for one million electric vehicles in less than ten years. Brown had also attempted to implement a measure that would have enforced a 50 per cent drop in petroleum use by 2030, but this was defeated by oil interests.

"What has been the source of our prosperity now becomes the source of our ultimate destruction, if we don't get off it," Brown said at a signing ceremony in October.

The targets received the support from California's utilities but opponents have expressed concerns about the impact of increased levels of renewable energy on consumer bills. The measures will cut carbon pollution from the power sector by 40 per cent below 2020 forecast levels, according to the Natural Resources Defense Council (NRDC).

California already has some of the world's toughest air quality standards, and set a mandate in 2006 to derive a third of its electricity from renewable sources such as solar, wind and geothermal by 2020. State regulators say the state reached 25 per cent renewable generation last year.

"California has taken its climate and clean energy leadership to new heights," said Ann Notthoff, NRDC California Director. "No state has ever set such aggressive clean energy goals as California is doing now. With Governor Brown's signature on SB 350, California is once again showing the world what can and should be done to fight climate change.

"But our work is not done. Reaching the targets established in law today will require a heavy dose of California's innovative spirit and grit, and we must ensure all polluters are held accountable as we continue to make progress."

Brown has not outlined how the targets will be implemented, leaving the details to the state's Air Resources Board, Energy Commission and Public Utilities Commission. Fines will be levied on utilities if targets are not met.

California's use of renewable energy has doubled in the last six years and widespread deployment of wind and solar energy in California as well as elsewhere has helped to reduce costs. Expanding use to 50 per cent of the electricity market could have implications for the electricity grid and utilities may be required to invest more heavily in network upgrades as well as incentivise consumers to reduce peak load use.

According to the US Department of Energy, Californians' average cost for electricity is 32 per cent higher than the national average. But a mild climate and years of energy efficiency rules have driven California residents to consume nearly half as much electricity per capita as the national average, so the average home electricity bill is $90 a month, 19 per cent lower than the national average of $111.

US PV market expects strong growth

Federal and state incentives, falling costs and growing consumer awareness of environmental issues will help to drive continued growth in the US solar photovoltaic (PV) sector.

New research indicates that the US PV market will reach 60 GW of installed capacity by 2022, with non-residential segments of the market playing a key role.

Hexa Reports says that in 2014, the utility PV segment remained the largest sector in the market, accounting for half of all installations. The US has an installed PV capacity of over 20 GW, according to the Solar Energy Industries Association (SEIA).

Hexa indicates that the favourable regulatory framework, coupled with declining costs, will continue to drive growth in the non-residential market segment, which is expected to achieve a compound annual growth rate (CAGR) of over 15 per cent from 2015 to 2022.

Residential solar is expected to witness high growth rates until 2016, after which the Investment Tax Credit (ITC), a key market incentive, is due to expire.

California has the largest installed PV capacity in the USA and is expected to continue to grow strongly due to high solar irradiance and tax incentives. Residential installations will drive strong growth in North Carolina, partly because of high power prices in the state.

SEIA stated in September that as much as 1393 MW of PV capacity was installed in the US in 2Q 2015, with the residential market accounting for 473 MW, a new quarterly record. Some 729 MW of utility-scale solar came on-line in 2Q 2015, and overall, 2.7 GW of PV capacity was installed in the first six months of 2015.

The US is on track for installing 7.7 GW of PV capacity in 2015, a new record, said SEIA.

"The demand for solar energy is now higher than ever and this report spells out how crucial it is for America to maintain smart, effective, forward-looking public policies, like the ITC, beyond 2016," said Rhone Resch, SEIA President and CEO.

Iberdrola expands Mexican portfolio

Mexico is adding more power generating capacity to its grid to help meet rising energy demand.

Spanish firm Iberdrola has announced plans to build an 850 MW gas fired combined cycle power plant in the northern state of Nuevo Leon, with construction scheduled to begin in 2016.

Under the terms of the contract awarded by the Mexican government, the Spanish company will be responsible for the construction, operation and maintenance of the plant and also be the owner of the facility.

Iberdrola will sell all of the energy produced by this facility to state-owned electric utility CFE under a 25-year contract with fixed capacity charges.

The plant will feature two state-of-the-art gas turbines and a steam turbine provided by Japanese manufacturer Mitsubishi Hitachi Power Systems, while Amec Foster Wheeler will supply the boilers.

Iberdrola's energy generation projects in Mexico amount to a combined investment outlay of $1 billion, while the company also plans to invest up to $5 billion in the country over the next five years, the company said.

Its current projects include two new combined cycle power plants – Baja California III and Dulces Nombres V, three cogeneration plants and two wind farms.

Mexico is also reported to be considering adding new nuclear energy capacity to its grid.

Under consideration by the government is a plan to add two new reactors to the existing Laguna Verde nuclear power plant.

Southern Company explores global options for clean coal

- Deal with Kepco using TRIG technology
- Kemper plant delayed with added costs

Southern Company is to join forces with Korea Electric Power Corporation (Kepco) in a move to explore global opportunities for the deployment of clean coal power generation and carbon capture and storage (CCS) technologies.

Southern's subsidiary, Southern Company Services, announced that it has signed a memorandum of understanding (MOU) with Kepco through which the firms will initially examine opportunities in the USA, Republic of Korea and developing nations.

Among the technologies the firms propose using is Southern's Transport Integrated Gasification (TRIG) system, which lies at the heart of the Kemper clean coal plant that is being built by Southern's subsidiary Mississippi Power.

They will also evaluate Kepco's own CCS technologies at the US Department of Energy's National Carbon Capture Center (NCCC) in Alabama, which is operated by Southern Company Services.

The Obama administration's drive to reduce emissions from existing and new fossil fuel fired power plants in the USA appears to be reviving interest in CCS in the USA.

Last month Basin Electric said that it would build a new integrated test centre (ITC) for CCS technology research and development at its Dry Fork Station near Gillette, Wy.

Elsewhere, Utah-based Sustainable Energy Solutions is developing a technology known as cyrogenic carbon capture. This is a post-combustion technology that can remove up to 99 per cent of carbon emissions from fossil fuel fired power plants at half the cost and energy of current carbon capture processes.

Southern's announcement came just weeks after a new assessment of its Kemper project revealed further delays and cost overruns at the plant.

Kemper has been operating on natural gas since August 2014 and the gasifier is almost complete, says Southern.

The projected cost of the plant is now $6.27 billion, compared with an original price tag of $2.4 billion.

India attracts clean energy investment

India's clean energy plans continue to attract investment as the country submits its national pledge on climate change.

Syed Ali

International investment is flooding into India as the country's clean energy plans continue to gain traction.

Chinese tycoons Liang Wengen and Nan Cunhui recently announced they plan to pour $5 billion into India's renewable power sector. Liang's Sany Group will install 2000 MW of capacity from 2016 to 2020 at a cost of $3 billion, while Chint Group Chairman Nan said his company would invest $2 billion into solar power.

Other billionaires such as SoftBank Group Corp.'s Masayoshi Son and Foxconn Technology Group's Terry Gou have also outlined plans for substantial investment in clean power in India.

Some analysts, however, remain cautious as to whether the announcements will translate into actual investment. Raj Prabhu, chief executive officer of Mercom Capital Group, a cleantech communications and research company, said: "There have been billions in commitments made to invest in the Indian renewable sector over the last few years, which the government uses to tout as interest from the private sector. However, very little of these commitments turn into a real investment," he said.

The government has been acting to make projects more attractive to developers. Notably, India's strategy of a foreign currency-denominated tariff plan for solar energy is aimed at providing solar power at a new low of Rs.4.75 ($0.073) per unit to the states. This will not only see solar power cost become the same as that purchased from the grid but will also reduce risks and make projects more bankable.

India's burgeoning solar market has seen a number of companies moving to set up solar operations there. In late September Chinese energy giant Golden Concord Group entered a strategic pact with Adani Enterprises to cooperate in the energy sector, including setting up an industrial park with a complete photovoltaic industry chain in Gujarat.

India plans a fivefold boost in renewable energy capacity in the next five years to 175 GW, including solar power, wind, biomass and small hydropower dams.

These plans received a boost in early October with the news that Germany will provide €2 billion ($2.2 billion) to India to boost solar energy and green infrastructure across the country.

A joint statement from the two nations confirmed that €1 billion will be delivered over five years to assist India in meeting its target of deploying 100 GW of solar by 2022. The remaining €1 billion will go towards "green energy corridors" linking major cities, and improving electricity access in rural areas.

Commenting on the deal India's Prime Minister Narendra Modi said: "I admire German leadership in clean energy and commitment to combating climate change. This is an area where we have convergence of views, and rapidly growing cooperation… We look forward to a concrete outcome at COP21 in Paris that strengthens the commitment and the ability of the world, especially of poor and vulnerable countries, to transition to a more sustainable growth path."

Just ahead of the announcement India published a target to generate 40 per cent of electricity from non-fossil fuel sources by 2030, stating it will boost solar, wind and nuclear capacity to reach the target.

The country also submitted its Intended Nationally Determined Contribution (INDC) climate plan to the UN ahead of the crucial UN Climate Change Conference taking place in Paris in December which includes the target to cut its greenhouse gas emissions for each unit of GDP 33-35 per cent from 2005 levels by 2030.

■ ABB, a power and automation technology group, has energised the first pole of the North-East Agra 800 kV ultra-high voltage direct current, or UHVDC, transmission link, which will supply clean hydropower from northeastern India to a substation in Agra, and from there, feed it across north India. When fully commissioned in 2016, the link will become the world's first multi-terminal UHVDC connection.

Raising $1 billion for Bataan

GN Power Mariveles Coal Plant Ltd. Co. plans to raise as much as $1 billion by year-end to start construction of the first unit of the 2x600 MW Bataan coal fired power facility in 2016.

"We're hoping to close [financing] by this year. That's our target, at least for the first unit," said AC Energy Holdings Inc. President and CEO John Eric T. Francia. "We will borrow all of it. We have to fund all of it to start construction."

Meanwhile, Sarangani Energy Corp. (SEC) of Alsons Power group has started commissioning the first 105 MW unit of a 210 MW coal fired power plant, putting it on track to make available additional supply to the Mindanao grid by early 2016.

The Philippines is investing in coal fired plants

Nuclear will support China's climate ambitions

China says its experience in building nuclear plants will enable rapid expansion of a generating source that will help cut CO_2 emissions.

Currently the nation has 23 nuclear power plants in operation, and 27 with a capacity of 30 GW are under construction. Under the next Five Year Plan (2016-2020), nuclear installed capacity is targeted to reach 58 GW.

China Energy Research Society vice director Zhou Dadi recently told the *China Times*: "After decades of development, China boasts advanced technology and valuable experience to build more nuclear power plants."

Zhou said that China generates only about 2 per cent of its total electricity through nuclear, while the average global proportion is 14 per cent.

At the end of September China completed preliminary reviews for 31 nuclear plant sites. An official from the Energy Research Institute of the National Development and Reform Commission (NDRC) said: "A report based on the research has been submitted to the State Council. Once approved, it will be a signal of the beginning of the operations of new nuclear reactors."

China stopped its nuclear power projects following the Fukushima nuclear disaster in Japan and has only approved a handful of new projects in eastern coastal areas.

Concern about climate change is one of the drivers for countries like China to introduce or to expand their use of nuclear power. However, China's nuclear plans are only part of a multi-pronged strategy to cut greenhouse gas emissions.

For example, in late September the country said it is planning a series of solar-thermal power pilot projects to help develop the technology.

China also announced that it will launch the biggest carbon emissions trading market in the world in 2017.

The announcement by Chinese President Xi Jinping was part of a joint climate change statement with the United States meant to boost momentum in the build-up to the United Nations Climate Change Conference in December when a global climate deal is due to be signed.

The joint climate statement builds on the landmark announcement Xi and Obama made last year when China and the US made ambitious commitments to reduce greenhouse gas emissions beyond 2020.

IEA report calls for reforms in Southeast Asia

- Region requires $2.5 trillion of investment
- $36 billion spent on fossil fuel subsidies

Syed Ali

The 'World Energy Outlook Special Report on Southeast Asia' (WEO Special Report) published by the International Energy Agency (IEA) says the region needs reforms if it is to attract much needed investment.

The WEO Special Report, prepared in collaboration with the Economic Research Institute for ASEAN and East Asia (ERIA), analyses four key issues that will shape the future of Southeast Asia's energy system: energy investment, power grid interconnection, energy access and fossil fuel subsidies.

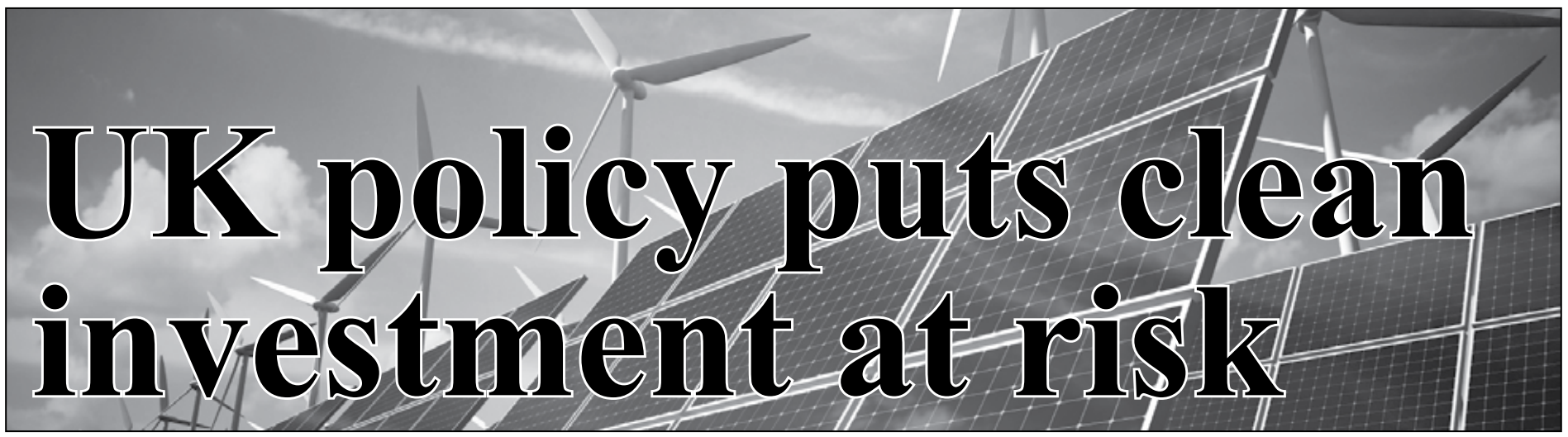
"The reliability and sustainability of Southeast Asia's energy system depends on investment," IEA Director of Energy Markets and Security Keisuke Sadamori said at the release of the report in Kuala Lumpur during the ASEAN Ministers on Energy Meeting.

"To secure its energy needs, the region requires $2.5 trillion of investment in energy supply infrastructure in the period to 2040, but for this to materialise we need to see more progress with reforms to domestic energy markets and the establishment of improved policy frameworks."

The report calls for more efforts to reduce subsidies to fossil fuels, noting that the region spent $36 billion on fossil fuel subsidies in 2014 despite reforms in Indonesia, Malaysia, Thailand and Myanmar.

The report also notes that greater integration of the region's energy markets could help catalyse development of energy resources, facilitate more efficient use of the region's resources and enhance energy security.

A separate IEA report, 'Development Prospects of the ASEAN Power Sector', further emphasises the importance of the power sector in the region's future. The report, highlights the role that power sector governance can play in supporting the development needs of the region, and pays particular attention to the implications of renewable energy integration in power sectors that currently rely significantly on fossil fuels.



UK policy puts clean investment at risk

Critics believe that the UK government's proposals to cut support for renewable energy will risk thousands of jobs as well as the country's reputation for clean energy development.

Siân Crampsie

The UK government has been widely criticised for implementing a number of policy changes that will reduce investment in renewable energy.

Energy companies, think tanks and environmental groups believe that plans to cut renewables obligation (RO) and feed-in tariff (FIT) support for solar and wind energy will undermine the UK's attempts to cut carbon emissions as well as damage the country's renewable energy industry.

Last month Professor Jacqueline McGlade, chief scientist of the UN's environment programme and a former head of the European Environment Agency, criticised the UK's proposed cuts as "disappointing" and being at odds with other countries that had pledged to cut emissions in the run-up to the Paris climate meeting next month.

"What I'm seeing worldwide is a move very much towards investment in renewable energy. To counterbalance that, you see the withdrawal of subsidies and tax breaks for fossil fuels," McGlade told the BBC.

McGlade also highlighted the fact that the UK planned to reduce subsidies for renewables but was pushing forward with its agenda for fracking and the construction of new nuclear power plants.

The UK's Department of Energy and Climate Change (DECC) has said that it is committed to driving growth in the low carbon economy but believes that subsidies for wind and solar energy will impact consumers' bills if growth rates continue.

It has proposed a total of 15 changes to renewable energy support mechanisms since May, according to the Renewable Energy Association (REA), including an early end to RO support for large-scale solar farms, and drastic cuts of up to 87 per cent for FITs.

However, the government's plans for an early end to RO support for onshore wind energy were defeated in the House of Lords last month after lawmakers passed an amendment to the Energy Bill.

The Aldersgate Group, a corporate and civil group alliance, urged the government to extend or replace its low carbon support policies in order to provide more clarity for the broader economic sector.

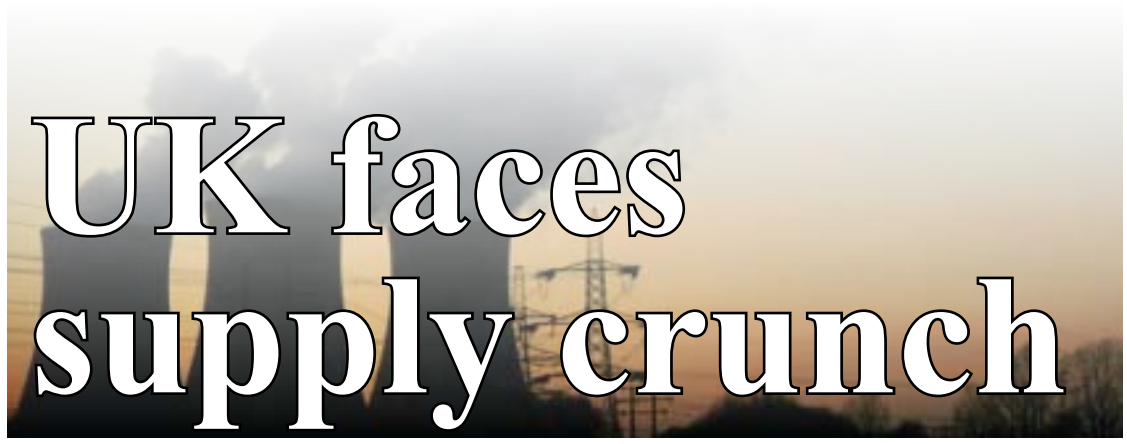
"The low carbon sector is now at a crossroads, with urgent clarity needed in particular on the funds available to support investment in low carbon power stations in the 2020s and on the support mechanisms that will help improve the efficiency of the UK's building stock," said Nick Molho, Aldersgate Group's Executive Director.

Molho added that the lack of long term policy signals extended beyond the renewables sector and could also affect other infrastructure sectors.

Last month Carlton Power said that construction of a new 1.9 GW gas fired power plant in Greater Manchester would be delayed because it found it difficult to secure investment.

Carlton power, which was awarded a contract under the UK's new capacity market system, said that uncertainty caused by cuts to wind and solar subsidies were partly to blame for its difficulties.

REA and the Solar Trade Association (STA) have warned that thousands of jobs across the renewable energy sector's supply chain are at risk from DECC's policy changes. At least four solar energy companies have filed for administration in the last few weeks.



UK faces supply crunch

Industry experts have warned that the UK faces its biggest risk of blackouts in a decade this winter because of a declining capacity margin.

National Grid last month released its *Winter Outlook* report, indicating that the margin figure for winter 2015/16 is 5.1 per cent, equivalent to a loss of load expectation of 1.1 hours and well within the reliability standards set by the government.

The decline in the capacity margin has been caused largely by the closure of old coal fired power plants that are deemed uneconomic or unable to comply with new EU emissions rules.

At the same time, the construction of new natural gas fired power plants is not economic at current electricity prices.

National Grid has contracted some 2.4 GW of additional balancing services to help it manage peak demand periods, including 133 MW from businesses willing to reduce demand in return for payment if required.

"Electricity margins are manageable throughout the winter period and we believe we have the right tools in place to manage the system," said Cordi O'Hara, Director of UK Market Operations at National Grid.

"Overall, energy capacity has dropped because of the closure of three UK power stations since last winter," said Tanuja Randery, President UK & Ireland at Schneider Electric. "Investment in renewable energy must be encouraged as a means of avoiding future energy crunches.

"Just 9.5 per cent of the UK's electricity was generated by on- and offshore wind in 2014, but much more green energy production is possible. Cuts to subsidies and the curtailment of significant renewable energy projects needs to be reviewed, and quickly," he said.

Sweden makes pledge to become fossil fuel-free by 2050

Sweden is aiming to become the world's first country to be fossil fuel-free.

In a speech delivered to the UN General Assembly, Swedish Prime Minister Stefan Löfven said that the country would boost investment in clean technology, including smart grids and clean transport, and renewable energy in a bid to become free of fossil fuels by 2050.

In its autumn budget statement, announced in September, the Swedish government said it would spend SKr4.5 billion ($545 million) next year on renewable energy and climate change activities.

At the same time, it outlined plans to invest in solar energy, wind farms, electric vehicles and to increase environmental taxes.

Sweden already generates around two-thirds of its electricity from renewable sources. Löfven told the Swedish Parliament: "Children should grow up in a toxin-free environment; the precautionary principle, the removal of dangerous substances and the idea that the polluter should pay are the basis of our politics."

Kriegers Flak receives key approval

Danish and German grid operators say that European approval of a key interconnection link will pave the way for the development of an offshore grid in Europe.

The Kriegers Flak combined grid solution will connect two offshore wind farms in the Baltic Sea with onshore grids in eastern Denmark and Germany. It will be built by Energienet.dk and 50 Hertz, and will start operating by the end of 2018.

"The approval by the European Commission is an acknowledgement to our work in integrating renewable energy sources with innovative approaches while strengthening the European electricity market," said Boris Schucht, CEO of 50Hertz. "It shows that cooperation between the European transmission system operators is the right answer to the challenges of the energy transition.

"With the Combined Grid Solution we create the nucleus for an offshore grid in the Baltic Sea, a milestone in the development of European grids."

The 400 MW interconnection will link the Danish region of Zealand and German Mecklenburg-Western Pomerania. It will improve security of supply and allow greater levels of power trading across borders, Energienet.dk said, and will receive funding of up to €150 million from the European Energy Programme for Recovery (EEPR).

Germany already has two offshore wind farms in the area, Baltic 1 (48 MW) and Baltic 2 (288 MW), while Denmark is currently preparing to erect the offshore wind farm Kriegers Flak (600 MW). The wind farms Kriegers Flak and Baltic 2 are located less than 30 km away from each other and will be connected by two submarine cables to establish the interconnector.

As eastern Denmark and Germany are two different synchronous areas, a frequency conversion is necessary. This will be done by two voltage source converters (VSC) that convert the alternating current (AC) from the Nordic synchronous area into direct current (DC) and directly back to AC, now adapted to the European synchronous area.

- Denmark's cumulative installed capacity is expected to expand from 13.5 GW to 16.1 GW by 2025, with more than half of the total power generation in 2020 coming from non-hydro renewables, according to analyst firm GlobalData. Wind power is expected to account for 45 per cent of generation in 2020.

Samsung halts Kazakh power project

Construction of a 1320 MW coal-fired power plant in Kazakhstan has been halted because of uncertainties over the purchase of power from the project.

Samsung Engineering said in late September that it was having difficulty raising funds for the project "because of an issue with the Kazakhstan government over the guaranteed purchase of the power to be produced from the project", CEO Park Jungheum said.

Samsung recently won the contract to build the Balkhash power plant. Construction of the plant, near the financial capital of Almaty, was scheduled to be completed by the fourth quarter of 2017. A venture between Samsung C&T, Korea Electric Power Corp. (Kepco) and Kazakhstan started developing the $2.2 billion project a few years ago.

Kazakhstan is also examining the possibility of developing new nuclear power capacity.

Its Energy Ministry told reporters last month that companies from six different countries had expressed an interest in participating in a new nuclear construction project.

Kazakhstan has identified two possible sites for a new nuclear reactor: Kurchatov town in East Kazakhstan province; and Ulken village in Almaty province.

Kazakhstan is studying nuclear possibilities

Asia wins in global PV growth race

■ CSP and PV capacity set for growth ■ Solar funding rises

Asia-Pacific is set to overtake Europe as the world's largest solar photovoltaic (PV) market.

According to global research firm, GlobalData, the Asia-Pacific region will increase its cumulative installed PV capacity from 63.3 GW in 2014 to 345.33 GW by 2025.

China will be the largest single contributor in the region, adding 198 GW of solar PV capacity by the end of 2025. Japan and South Korea will also experience strong growth, says GlobalData.

The firm also says that the global installed capacity of concentrating solar power (CSP) will increase over the next five years, with China once again leading the market.

CSP capacity globally will increase from 282.5 MW in 2014 to reach 1.3 GW by 2020. South Africa is expected to make a growing contribution to the market.

Harshavardhan Reddy Nagatham, GlobalData's Analyst covering Power, said: "South Africa's climatic conditions are highly suited to CSP technology, due to high Direct Normal Irradiance (DNI) rates throughout most of the country and the availability of vast expanses of land.

"South Africa's first CSP plants were commissioned in 2010 and had a combined capacity of 0.2 MW, but the country now has the world's third-largest installed CSP capacity, despite only having an installed photovoltaic capacity of 1.5 GW."

While GlobalData forecasts that South Africa's CSP installed capacity will hit 193.3 MW by 2020, China will lead the world with 582.3 MW by the end of the forecast period.

Nagatham continues: "China remains the fastest growing CSP market in the world, high DNI concentration levels in the western part of the country combined with China's manufacturing capacity, has made it home to the largest existing CPV plants and the highest number of upcoming large-scale plants.

"The government has targeted 100 GW of installed solar capacity by 2020, but there has been speculation that the target will be revised to 200 GW. While only a small portion of this upcoming capacity would be in the form of CSP installations and the rest would be regular PV installations, China would still represent a major part of the global installed CSP capacity in 2020."

Global growth in PV and CSP technologies is being driven by declining prices and commitments to renewables from governments in the region. China alone has set a target for renewables to account for 20 per cent of its total energy mix by 2020.

Growth in the global solar sector is reflected in new research from Mercom Capital Group, which shows that total global corporate funding in the solar sector, including venture capital/private equity (VC), debt financing, and public market financing raised by public companies, came to $6.2 billion in Q3 2015, compared to $5.9 billion in Q2 2015.

VC funding in Q3 increased to $257 million in 15 deals, compared to $142 million in 24 deals in Q2 2015, said Mercom. Solar downstream companies continued to draw most of the VC investments with $114 million in seven deals.

Public market financing in Q3 fell to $1.8 billion compared to $2.3 billion in Q2 2015, with three IPOs: Terraform Global, Sunrun and Grenergy Renovables. Debt financing increased in Q3 2015 compared with Q2, with Chinese firms dominating debt financing activity.

Wind energy gathers pace in Jordan

Jordan is making progress in its pledge to diversify its energy resources into renewable energy.

The country's National Electric Power Company (NEPCO) and Jordan Wind Project Company (JWPC) announced the start of commercial operations at the Tafileh wind farm, the first utility-scale wind farm in the Kingdom.

Separately, the Jordanian government has signed an agreement with UAE's Green Watts Renewable Energy Company to buy electricity from a wind power plant located in the south of Jordan.

JWPC's Executive Chairman Samer Judeh said that the Talifeh plant is operating at its full capacity of 117 MW. The project will produce approximately 400 GWh of energy per year.

The $287 million project, built in the southern governorate of Tafileh, will account for three per cent of the total energy currently produced in Jordan.

Green Watts Renewable Energy is building an 82 MW wind farm in Maan governorate at a cost of $200 million. The wind farm is scheduled to start operating in late 2018.

Jordan has started up its first wind farm

New fund launched for renewables in Africa

Jean Louis Borloo, the former French energy minister, has launched a new project aimed at raising funds for renewable energy projects in Africa.

The Energies for Africa project plans to tap developed countries for funding that would seed renewable energy projects on the continent, which has the largest renewable energy potential in the world, according to the International Renewable Energy Agency (IRENA).

Borloo is aiming to raise funds of $3 billion by the end of 2016, and $5 billion by the end of 2018. He says that he has already received commitments from 44 countries to participate in the project, an indication that the continent is becoming an attractive investment proposition for renewable energy.

In October, IRENA said that Africa could generate nearly one quarter of its energy needs from renewables by 2030, four times more than the five per cent contribution made by renewables in 2013.

The organisation has published the findings in a new report that also finds that scaling up modern renewables in Africa is an affordable means to help meet fast-growing energy demand while increasing energy access, improving health and achieving sustainability goals.

"Africa holds some of the best renewable energy resources in the world in the form of biomass, geothermal, hydropower, solar and wind," said IRENA Director-General Adnan Z. Amin. "This, combined with the precipitous drop of renewable energy technology costs, creates a massive opportunity for African countries to both transform and expand their energy systems while providing a pathway for low-carbon economic growth."

The report identifies nearly 10 exajoules – the equivalent of more than 341 megatonnes of coal – of options for sustainable development through renewable energy. Roughly 40 per cent of this energy would be in the power sector.

Solar resources are abundant across the continent, says IRENA, while biomass and hydropower potential are more plentiful in the central and southern regions. Wind resources are strongest in the north, east, and southern regions, and geothermal energy is strong in the Great Rift Valley.

Other funds targeting renewable energy in Africa are also seeing success. In September, the African Renewable Energy Fund (AREF), a dedicated renewable energy fund focused on sub-Saharan Africa, announced that it successfully reached its final close at its hard cap, with $200 million of committed capital to support small- to medium-scale projects.

Among other investors at the final close are European Investment Bank (EIB) and the Global Energy Efficiency and Renewable Energy Fund (GEEREF). The fund, managed by Berkeley Energy, held its first close of $100 million in March 2014 and since that time has been investing capital in grid-connected development stage renewable energy projects, including small hydro, wind, geothermal, solar and biomass projects.

EDF plans disposals for new nuclear projects

EDF is likely to launch a major asset disposal programme in order to preserve its credit ratings in preparation for construction of a new nuclear power reactor in the UK.

Siân Crampsie

French energy group EDF is likely to sell assets in the coming years in preparation for the construction of a new fleet of nuclear reactors in the UK.

French newspaper *Les Echos* has reported that the company could sell up to €10 billion of assets over five years in order to help maintain its credit ratings.

The disposals could include the exploration and production operations of Edison, its Italian subsidiary, as well as its stake in American nuclear group CEGN.

In addition to the construction of three new nuclear reactors in the UK, EDF is set to purchase the reactor division of nuclear firm Areva as part of a deal masterminded by the French government.

Last month EDF announced that it had signed a strategic investment agreement with Chinese firm CGN under which it will take a 66.5 per cent share in the proposed Hinkley Point C nuclear power project, while CGN's share will be 33.5 per cent.

EDF and CGN have also agreed on the terms of a wider partnership for the joint development of new nuclear plants in the UK, at Sizewell and Bradwell.

In October credit ratings agency Moody's said that the deal with CGN, signed during a visit to the UK by Chinese President Xi Jinping, would not affect its current credit rating of Baa1 with a negative outlook. However it warned that the Hinkley Point C project was "inherently risky owing to its scale and complexity".

In a research note, Moody's said: "If the decision is eventually taken by EDF to go ahead with the [Hinkley Point C] project, its significant scale and complexity are likely to affect the group's business and financial risk profiles, in Moody's view.

"HPC will only be the fifth plant using the European Pressurised Reactor technology to be constructed globally – none of which is operational yet. The risk of constructing the power station to budget and schedule will remain with, and be shared by, EDF and its partners."

Hinkley will cost an estimated £18 billion to build, a figure that will be fully consolidated on EDF's balance sheet, said Moody's. "Whilst the proposed investment will further weigh on its credit profile, the ultimate impact will depend on any mitigating measures that EDF's management may take to absorb the incremental risks associated with the HPC project, including asset disposals," said Moody's.

Nordex details Acciona merger deal

Nordex and Acciona say that their merger plans will create a major new player in the global wind energy sector.

The two firms have agreed to a buy-out of Acciona Windpower by Nordex in a cash and share deal €785 million.

The deal would bring together two firms with complementary product portfolios and geographical spreads, and will enable growth and reduce exposure to demand swings in regional markets.

"Both Nordex and Acciona Windpower have demonstrated ability to grow at impressive pace in recent years and in combining our business activities we are laying a robust foundation for future profitable growth," said Lars Bondo Krogsgaard, CEO of Nordex SE.

"We are confident that both Nordex and Acciona Windpower customers will realise value from our companies' combined expertise."

Nordex has a strong market position in Europe, while Acciona Windpower is well positioned in the Americas and emerging markets. Nordex products are particularly well suited for complex projects that are subject to technical restrictions, while Acciona Windpower's products are primarily aimed at large-scale wind farms that require efficient and sturdy machines for unconstrained terrains.

Nordex will pay €366.4 million in cash for Acciona Windpower as well as 16.1 million new Nordex shares valued at €26 each. Alongside the transaction Nordex's current main shareholder SKion/momentum will sell shares in Nordex to Acciona, which is one of the biggest owners and operators of wind farms in the world.

SKion/momentum's and Acciona's post-transaction shareholdings in Nordex will be 5.7 per cent and 29.9 per cent, respectively.

New collaboration in offshore wind sector

RES and GES are to take advantage of growing opportunities in the offshore wind asset management and operations and maintenance (O&M) markets.

The two companies have signed a strategic alliance agreement to offer asset management and O&M services to the offshore wind industry, where early projects are now coming out of their initial warranty periods, thus creating new opportunities in AO&M.

In addition, a growing number of non-utility investors are taking ownership positions in the offshore wind sector and require expertise in AO&M to safeguard their assets.

RES, a global independent renewable energy firm, and GES, a service provider focused on the renewables sector, said that their new alliance would "address these changes by creating the resources and capabilities to provide services at scale, and safely through one team".

They will offer asset management and O&M services for wind turbines and balance-of-plant including transmission assets, as well as blade inspections and maintenance campaigns, major repairs and retrofits, subsea surveys, condition monitoring and reliability and control room services through a 24/7 control room.

They will also be able to conduct client representation and snagging activities to projects under construction. Clients will benefit from skilled project management and experienced large pool of technicians, bringing together multiple strands of expertise into a single, coherent contract.

Both businesses have a global presence, strong balance sheets and relevant experience spanning over 30 years each. RES currently manages 1.3 GW of assets, and GES maintains over 12 GW of operational assets.

Ormat, Toshiba team up

- Kenya's Menengai geothermal project targeted
- Firms combine flash and binary systems

Ormat and Toshiba say that a new partnership in the geothermal energy sector will enable them to offer customers more competitive solutions for project development.

The two companies have signed a strategic collaboration agreement to develop opportunities in the worldwide geothermal sector including resource assessment, field development, power plant engineering, procurement and construction (EPC) and power plant operation.

The collaboration will leverage Toshiba's experience in flash geothermal systems and Ormat's expertise in binary geothermal systems, enabling them to offer an efficient solution that combines the two technologies and meets the technological needs of geothermal projects around the world.

The move will help both firms to capture a larger portion of the global geothermal market, they said.

"This milestone collaboration with Toshiba, an innovation leader in the geothermal steam turbine industry, is another significant step in our long-term strategy to expand our presence in the geothermal space and ultimately target the larger renewable energy market," commented Isaac Angel, Chief Executive Officer of Ormat. "We view this collaboration as a key to support our strategic expansion in the geothermal industry to diversify our technological base, as well as extend our geographic reach.

"I believe that this collaboration of two market leaders, each with its own area of expertise, will enhance the value proposition to our clients, expand the market opportunities and accelerate the growth for both Ormat and Toshiba."

The first project to be implemented under the new agreement is the Menengai geothermal project in Kenya, which will be constructed and operated by a consortium of Ormat, Symbion Power LLC and Civicon Ltd.

That project is at an advanced stage of design and negotiations over a supply agreement have already started, said Ormat.

Ormat and Toshiba are also actively analysing global prospects for potential projects in which they can participate, they said in a joint statement.

Siemens aims to be climate neutral by 2030

Siemens has laid out its plans to be the world's first major industrial company to achieve a net-zero carbon footprint by 2030.

The company says that it will invest around €100 million over the next three years to reduce the energy footprint of its production facilities and buildings to halve its current carbon dioxide (CO_2) emissions of 2.2 million metric tonnes per year by 2020.

In the longer term, Siemens plans to use distributed energy systems at its production facilities and office buildings to optimise energy costs, employ low-emission vehicles and e-mobility concepts in its global car fleet, and move toward a clean power mix by increasingly tapping sources of energy such as natural gas and wind power.

Other investments will include energy management systems and automation systems for buildings and production processes as well as energy-efficient drive systems for manufacturing to reduce its energy usage.

Siemens expects to slash its energy costs by €20 million a year. "Cutting our carbon footprint is not only good corporate citizenship, it's also good business," said Joe Kaeser, President and CEO of Siemens AG.

Americas

Wärtsilä builds El Salvador plant

Finnish power and marine technology company Wärtsilä is to build a new power plant in Acajutla, El Salvador.

The company has signed a contract with local energy firm Energia del Pacifico S. A., to build the 378 MW power plant in the coastal city.

The plant will be the largest power plant in the country, and the first in Central America to use LNG as fuel, according to Wärtsilä.

Construction will start in 2016 and the plant will enter operation in 2018.

H-class GTs ordered for Valle de México II

Siemens is to provide its H-class power plant technology to the 298 CC Valle de México II combined cycle power plant.

The German company has won a contract with a consortium consisting of Cobra Instalaciones y Servicios and Initec Energía from Spain, and Avanzia Instalaciones from Mexico, to supply two gas turbines, one steam turbine, three generators as well as a control system for the turbines.

The 615 MW power plant will be built in the municipality of Acolman and is scheduled to start operating in December 2017. It will be the second power plant in Mexico to be equipped with Siemens' H class technology.

Siemens is to also supply auxiliary equipment, materials, spare parts and special tools, as well as TFA onsite engineering support, it said.

Gamesa secures 98 MW Brazil wind turbine order

Gamesa has signed its first contract with Votorantim Energia for the supply, transportation, installation and commissioning of 98 of its G114-2.0 MW turbines at seven wind farms located in the state of Piauí, in eastern Brazil.

Gamesa will deliver the turbines in 2017 ahead of the facility's scheduled commissioning at the end of that year. The Spanish firm will also maintain the seven wind farms for a five year period.

The turbines will be equipped with Gamesa's MaxPower technology, which increases their nominal capacity from 2.0 MW to 2.1 MW, thereby boosting output from 196 MW to 205.8 MW.

EnerDel orders Ideal Power solution

EnerDel, a manufacturer of lithium-ion batteries and energy storage systems, has placed an order with Ideal Power Inc. for several of its grid-resilient 30 kW Multi-Port power conversion systems.

The multi-port power conversion systems are smaller and lighter than traditional power converters and enable the the integration of solar with battery storage and diesel generation using a single power conversion system, dramatically reducing the cost required to form stable, flexible microgrids.

The units will ship in late 2015 and will be used in multiple microgrid installations.

Asia-Pacific

Sungrow increases exports to Thailand

Sungrow is to boost its shipments of PV inverters to Thailand after signing a supply agreement with Super Block.

Sungrow will supply Super Block with 55.5 MW of PV inverters in a package that includes 60 central inverter stations, 604 units of PV combiner boxes and 60 units of data monitoring loggers. Shipment started in the middle of September, and the whole project is expected to be completed and start operation by the end of 2015.

Earlier this year Sungrow signed a deal with Super Block to provide it with 75 MW of inverters for solar projects in Thailand.

ABB to supply Chinese UHVDC links

ABB has won orders worth over $300 million for critical power technologies to enable two new ultra-high-voltage direct current (UHVDC) power transmission links in China.

The two 800 kV links will each have the capacity to transmit 8000 MW of wind and thermal power from Shanxi to Nanjing and from Jiuquan to Hunan – enough electricity to meet the needs of 26 million consumers based on average national consumption.

ABB will supply HVDC converters, converter transformers and components, capacitors and filters, and high voltage circuit breakers for the projects, which will help China to integrate more renewable energy and strengthen its grid.

The Jiuquan to Hunan project is the world's and China's second 800 kV UHVDC to 750 kV UHV alternating current (AC) connection, an innovation that also enhances the efficiency and capacity of long-distance UHV electricity delivery systems.

Myanmar PV project contracts awarded

Black & Veatch says that it will start developing a 250 MW solar power project in Myanmar in 2016.

The US engineering firm was awarded a series of contracts that will see it work alongside Thailand's Green Earth Power on the power plant, which will be the largest of its kind in Southeast Asia.

"Electricity is an urgent priority in Myanmar and has serious implications on economic and social progress," said Ric O'Connell, international renewable energy director at Black & Veatch. "As solar facilities can be built rapidly, it is an excellent alternative to quickly add power to the grid and ensure meaningful impacts on quality of life."

Harbin orders GTs for Pakistan project

Harbin Electric International Company Limited (HEI) has placed an order with GE for the supply of two 9HA.01 gas turbines and associated equipment for the new 1.1 GW Bhikki combined cycle power plant in Pakistan.

The order is the first for GE's HA gas turbine technology in the Middle East and North Africa region, said GE. HEI will carry out engineering, procurement and construction for the project.

The Bhikki plant will be able to generate the equivalent power needed to supply more than six million Pakistani homes, and is likely to be the largest, most efficient power plant in Pakistan. It is expected to enter commercial operation in 2017.

Europe

Nordex to install seven wind turbines in Turkey

Nordex has been awarded three contracts for wind farms with a capacity of a total of 45 MW in Turkey.

The firm is to install seven of its N117/3000 turbines close to the city of Izmir in western Turkey for its new customer Üçgen Rüzgar Enerjisi Elektrik Üretim Anonim Şirketi. It has also signed a separate deal to provide another new customer, Süper Enerji, with four wind turbines for installation at the Çataltepe wind farm near Istanbul.

In a third deal, Nordex is to supply five N117/2400 turbines to project developer REA Elektrik for the Zincirli wind farm in the province of Kayseri.

Nordex has installed a total of almost 1000 MW in Turkey, with a further 400 MW currently under construction. It holds around 23 per cent of the Turkish market.

Alstom upgrades Markersbach generators

Alstom has received an order from Vattenfall Europe Generation AG for the main overhaul of a synchronous generator in the Markersbach pumped storage hydro power plant located in the Ore Mountains in Saxony, Germany.

The order is the second for Alstom from Vattenfall following an earlier contract signed in mid-2014 to upgrade another of the plant's synchronous generators.

The overhaul comprises the delivery of a new stator, upgrading of the poles, bearings, bearing bracket and starting motor, as well as disassembly and re-assembly, including commissioning.

A contractual option covers the overhaul of the remaining four of the plant's generators.

Markersbach was commissioned in 1979 and has an installed capacity of 1050 MW. It is the second largest pumped storage hydropower station in Germany.

Vattenfall looks to Senvion

Senvion has signed a contract with Vattenfall to supply 16 Senvion 3.4M104 turbines to the Ray wind farm in northern England.

Installation of wind turbines at the 54.4 MW wind farm is expected to start in July 2016. It is the first project that Senvion has signed with Vattenfall in the UK using the 3.XM platform.

Siemens expands Clyde

SSE has placed an order with Siemens for the supply, installation and commissioning of 54 direct drive wind turbines at the Clyde wind farm in South Lanarkshire, Scotland.

The 54 SWT-3.2-101 machines will add 172.8 MW of capacity to the 350 MW Clyde facility, already one of the largest onshore wind farms in Europe.

Construction of the extension is already under way, with delivery and installation of the 54 Siemens wind turbines scheduled for June 2016. The project will be completed in June 2017.

Alstom supplies transformers for floating power plant

Alstom has signed a contract with Karadeniz Energy Group, to supply power transformers for the Karadeniz Powership Osman Khan (KPS12) power plant.

At 486 MW, the Karadeniz Powership Osman Khan will be the largest floating power plant in the world. Alstom will design, manufacture and deliver 200 MVA power transformers, inclusive of commissioning, field tests and respective spare parts.

Capstone reaps rewards of German growth

Capstone Turbine Corporation has received orders for a C200 and 19 C65 microturbines for multiple combined heat and power (CHP) projects in Germany.

E-Quad Power Systems GmbH, Capstone's German distributor, secured the orders, which will be rolled out over the next six months. Due to the rising volume of CHP orders in the region, E-Quad has relocated to a new, larger facility to better handle market growth.

The C200 microturbine will be installed at a large-scale industrial laundry facility as part of a joint steam production project with SAACKE Group. The C65 microturbines will be installed at various manufacturing and oil and gas production sites throughout Germany.

International

Umm AlQura signs maintenance agreement

Wärtsilä has signed a three-year agreement with Umm AlQura Cement Company to provide maintenance services for their power plant near Taif city, Saudi Arabia.

Under the agreement, Wärtsilä will assume full responsibility for the operation and maintenance of the power plant, which consists of five Wärtsilä 32 engines with a combined output of 47 MW.

The goal of the agreement is to ensure maximised lifetime and guaranteed performance and lifecycle costs for Umm AlQura, Wärtsilä said.

Alstom preferred bidder for Hassyan

A consortium comprising HEI and ACWA Power has selected a partnership of Alstom and Harbin International to be the EPC contractor for the Hassyan clean coal power plant in Dubai.

The HEI and ACWA Power consortium are preferred bidders for the 1200 MW Hassyan project, which will be the first ultra-supercritical (USC) coal-fired power plant in the Middle East.

The plant will be fitted with Alstom's USC boiler and steam turbine generator equipment, and will have dual fuel capability, said Alstom. It will also include advanced environmental control systems such as electrostatic precipitators (ESP) and seawater flue gas desulphurisation (SWFGD) systems, and will be CO_2 capture-ready.

GE bags Iraq contract

Mass Global Investment Company has placed an order with GE for the supply of advanced gas turbine for a new 3 GW power plant in Bismayah, Iraq.

Located just 30 km from Baghdad, the Bismayah power plant will support development in the region and also represents a first-of-its-kind independent power producer (IPP) deal between Iraq's Ministry of Electricity and Mass Global Investment Company.

It is also the first IPP project by Mass Global Investment Company outside Kurdistan, said GE.

GE will supply eight of its advanced 9F.03 gas turbines. The project will be developed in two phases, each consisting of two blocks of 1500 MW. Mass Global Investment Company has signed the EPC contract for the project with ENKA and is currently finalising the plans for the second phase.

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Oil

Lower crude price, high production spells trouble for Saudi Arabia

- Saudi Arabia could exhaust financial assets
- Deficit balloons to more than $140 billion

David Gregory

The Opec Basket was in the $43/b range in late October, similar to where it was priced the month before. Brent crude was below $48/b and West Texas Intermediate was under $45/b. With plenty of oil on the market, and China's economy in a slump, crude oil prices are not expected to head upward anytime soon.

Low oil prices are credited to Opec's, particularly Saudi Arabia's, decision to boost production in order to force US shale oil producers out of the market. That may be working to some extent, but it has yet to be proved that Riyadh's oil policy will bring prices back to the $100/b range where most Opec members need to have them.

Saudi oil production averaged 10.225 million b/d during September, down only slightly from August.

"Saudi Arabia is not changing course on its strategy of retaining market share which is evidenced by the fact that it is expected to cut the prices of crude it sells to Asia in November," the Saudi investment management firm, Jadwa Investment, said in its latest quarter report. "We therefore expect exports to remain at current levels for the remainder of 2015 and 2016."

"The policy implemented by Saudi Arabia over regaining market share seems to be paying off with Saudi crude exports amounting to around 8.1 per cent of the global market since November 2014, after falling to 7.9 per cent in 2014. Maintaining market share is even more of a priority now for Saudi Arabia than when prices began to fall in the second half of 2014," Jadwa Investment said.

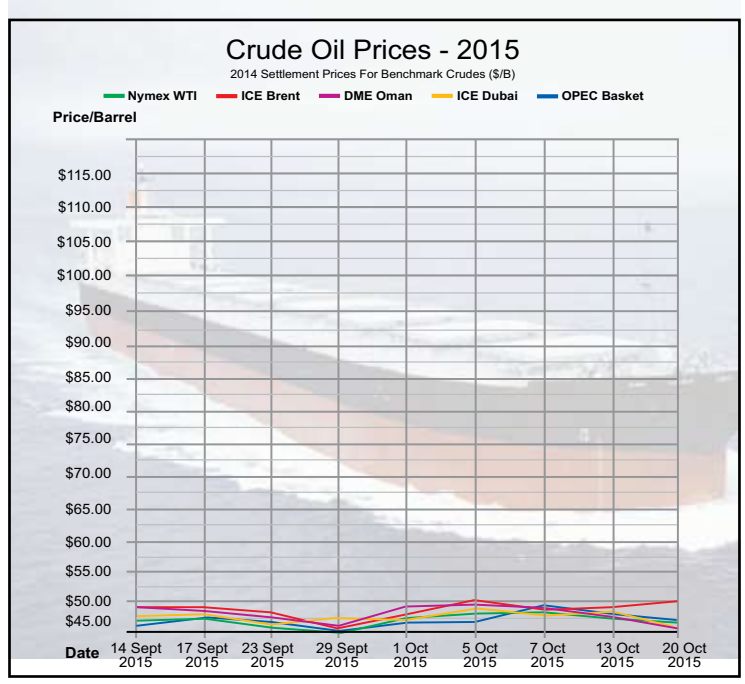
The report went on to say the global market is more competitive and Saudi Arabia faces competition from both within Opec and outside it. "As a result, our 2015 forecast for Saudi oil production is at 10.1 million b/d and, even as non-Opec supply slows in 2016, we see competition amongst Opec members keeping yearly Saudi production at 10.1 million b/d in 2016 as well," Jadwa said.

Much of that competition is expected to come from Iran, which is seen as returning to the oil market in a big way early next year once international sanctions are lifted. Iran is said to have some 40 million barrels of crude and condensate in floating storage that could readily be put on the market. Furthermore, Iran is gearing up to invite foreign investors into the country with a new model agreement contract designed to bring in some $100 billion of investment in its energy industry.

Iran's return to the oil market will keep supplies plentiful even if non-Opec supplies, such as US shale oil supplies fall away – but this will be only temporary. Shale will come back when the price goes up.

A prolonged slump in oil prices could have a seriously adverse impact on Saudi Arabia and other Persian Gulf oil producers, according to a new report by the International Monetary Fund (IMF).

The Washington-based IMF said Saudi Arabia could exhaust its financial assets within five years if it continues to spend in accordance with current policies. Bahrain and Oman are expected to face the same dilemmas, the organisation said, but stated that Qatar, Kuwait and the UAE have the financial assets to see them through another 20 years.



This year Saudi Arabia's deficit has ballooned to more than $140 billion. In order to maintain policies of subsidies and largess, the Saudi government has spent about $70 billion of its foreign assets, withdrawals from hedge funds and other investment mechanisms amount to about $70 billion and it has borrowed around $10 billion.

Saudi assets remain huge, about $650 billion, but if crude prices continue at an average of $50-60/b over the next two-to-three years, and spending continues as it has without a shift in economic policy, Saudi Arabia could be facing a situation that it is not used to.

If by then its strategy of boosting production in order to force out US shale producers has not worked, Saudi Arabia may have to re-think its plan. This could result in cutbacks in projects and social benefits, reductions in subsidies, and the introduction of taxes, such as VAT. It would have to introduce to its economy sustainable non-oil revenues and perhaps begin to rely less on imported labour.

The IMF urged the Gulf states to put reforms in place as soon as possible. "The oil price decline has increased the urgency for MENAP (the Middle East, North Africa, Afghanistan and Pakistan) oil exporters to adjust their fiscal policies," the IMF report said. "Because the oil price drop is likely to be large and persistent, oil exporters will need to adjust their spending and revenue policies to secure fiscal sustainability."

The report said that so far the steps taken towards reform have proved inadequate to achieve the needed medium-term fiscal consolidation.

Gas

Papua New Guinea attractive in slack LNG market

Despite falling LNG prices and a number of projects that are facing delays or rising costs, LNG projects in Papua New Guinea are attracting attention for those who see a strengthening demand for gas in the future.

Mark Goetz

The prospects for gas development and LNG exports in Papua New Guinea are such that it has been referred to as the "jewel in the crown" of Asian gas investment, attracting the attention of large operators.

Two projects are under way in the country: the Papua New Guinea LNG (PNG LNG) project led by ExxonMobil, which came into operation last year; and the Papua LNG project led by France's Total.

One regional investment analyst said recently of the PNG LNG project: "It offers tremendous resources potential, low development costs and lots of room for expansion. It's one of the few projects that we see as competitive in this new lower oil price environment, making it appealing to a lot of companies."

Australia's Oil Search, which holds a 29 per cent stake in the PNG LNG facility, in September turned down an offer of $8.5 billion from fellow Australian firm Woodside Petroleum. Oil Search described Woodside's offer as "grossly undervalued." Reports say that Woodside is considering an increase in the offer. ExxonMobil owns 33.2 per cent in the facility.

Another Australian firm Santos rejected an offer of $5.1 billion from Bermuda-based Scepter Partners for its 13.5 per cent share of PNG LNG. Scepter is owned by the ruling families of Brunei and the UAE.

Following that, Santos received an offer from Japan's Marubeni Corporation for a piece of Santos' stake. Reports said that Marubeni would be willing to pay $2 billion for 3.6 per cent of the company.

Much of the attraction of LNG projects in Papua New Guinea lies with the fact that production costs are lower than elsewhere, particularly than in Australia itself, which is now the third largest exporter of LNG and will become the largest exporter by the next decade.

With low taxes and cheap labor, producing LNG in Papua New Guinea can cope with markets of $6-8 per million Btu, compared to at least $10 in the US and more for that produced in Western Australia, which has seen its LNG dreams challenged by rising development costs and a slumping market. LNG prices in Asia were over $19/million Btu last year but now are below $7.

One of the world's poorest nations, Papua New Guinea can look forward to an improving economy as its natural gas resources are tapped and exported in the form of LNG. In the long run demand and prices are expected to pick up.

PNG LNG started production in 2014 with a capacity of 6.9 million tons per year (mn t/y) – the equivalent of about 9.5 bcm, but in recent months the plant has been producing at an average annual rate of 7.4 mn t/y and is expected to do so for the rest of the year and for 2016.

Oil Search said in its report for the third quarter that demand for the project's LNG on the spot market were "robust, reflecting the proven reliability of the plant and the high heating value of the gas relative to LNG projects globally".

Partners in the project are considering expanding the project by building a new train. A final investment decision is expected by end-2017 or in 2018, once sales and financing are secured. Exports from that train could begin by 2023.

Meanwhile, in the Papua LNG project France's Total is the operator of the Petroleum Retention License (PRL)-15, where the Elk-Antelope gas field development project is under way. Total, which holds a 40.1 per cent stake in the PRL-15 license, is planning to use the gas fields to feed a two-train LNG facility that will require a gas resource of 7-8 tcf over the life of the project.

Engineering work for the plant was to have begun in 2015 and a final investment decision is expected in 2018. It is estimated that the PRL-15 license holds a gas resource of about 5.4-9 tcf.

Papua New Guinea has also recently begun collaboration with Indonesia to develop oil and gas resources in eastern Indonesia. The two countries will share information concerning oil and gas policies, carry out joint surveys and studies, and consider joint LNG projects.

Papua New Guinea and Indonesia have already signed several energy agreements relating to cooperation with oil and gas resources in their border area and the sale and purchase of electricity between PT PLN (Persero) and PNG Power Ltd.

The International Energy Agency recently launched its *Medium-Term Renewable Energy Market Report 2015: Market Analysis and Forecasts to 2020*. According to the report, renewable energy will represent the largest single source of electricity growth over the next five years, driven by falling costs and aggressive expansion in emerging economies. A few key illustrations are presented below.

For more information, please contact:

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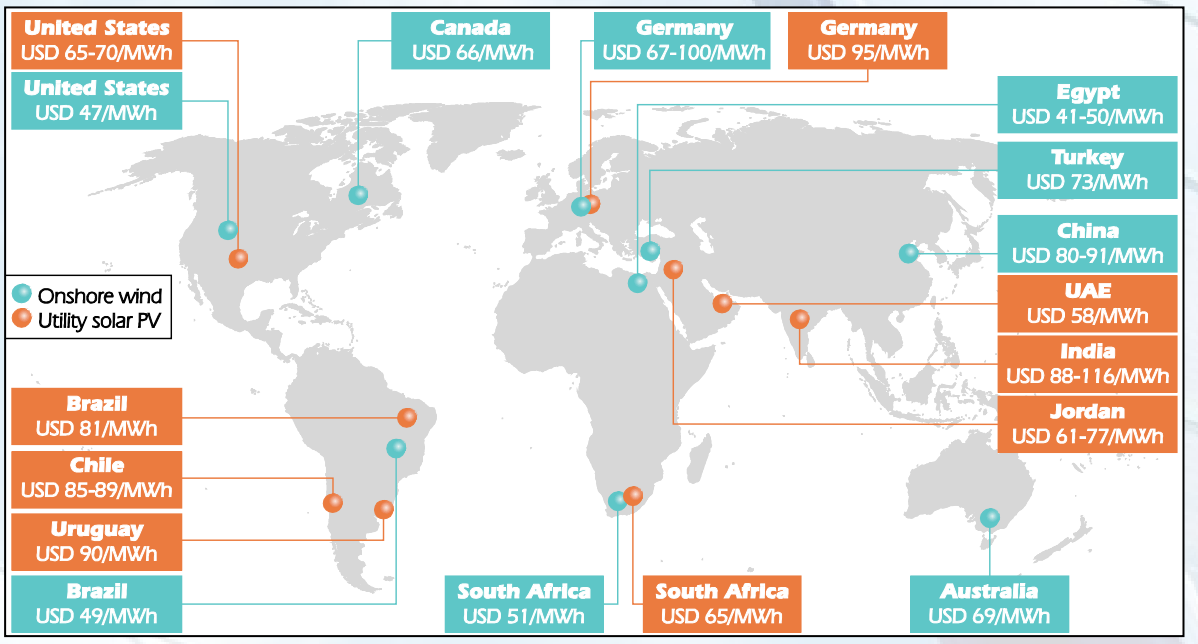
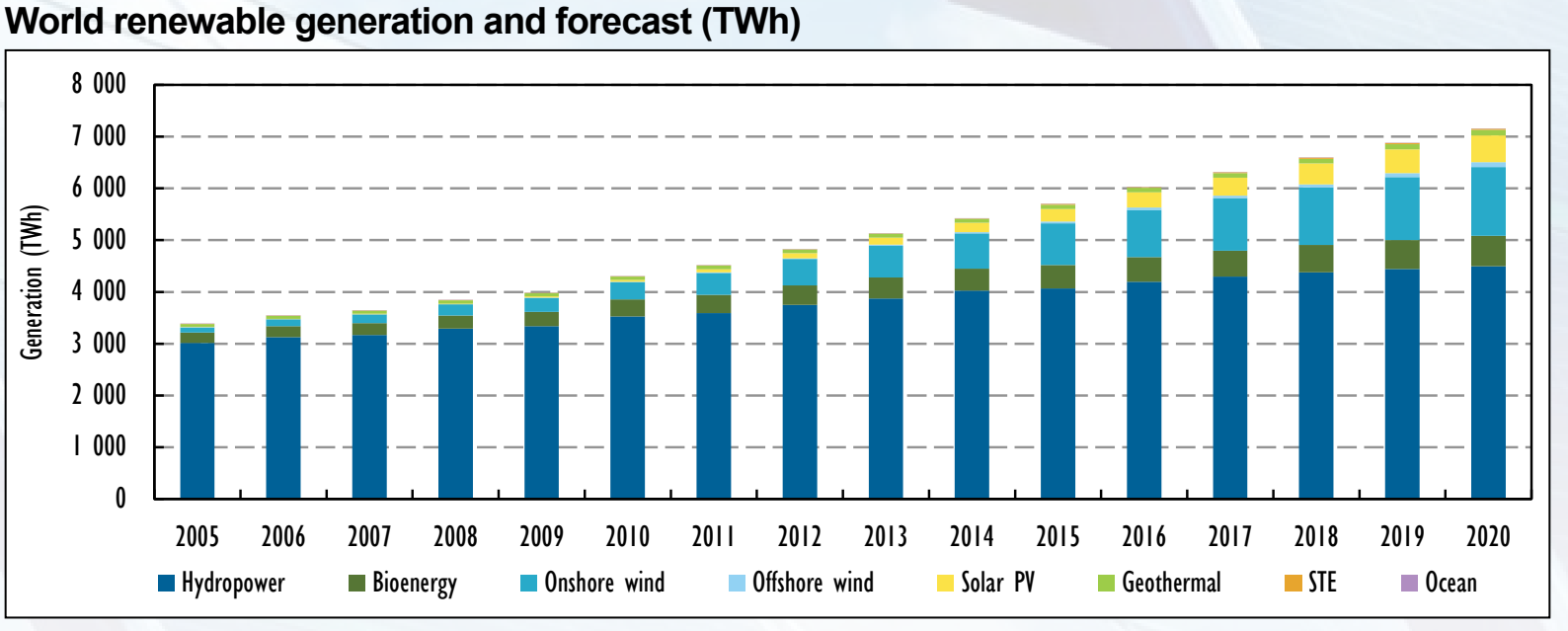
website: www.iea.org

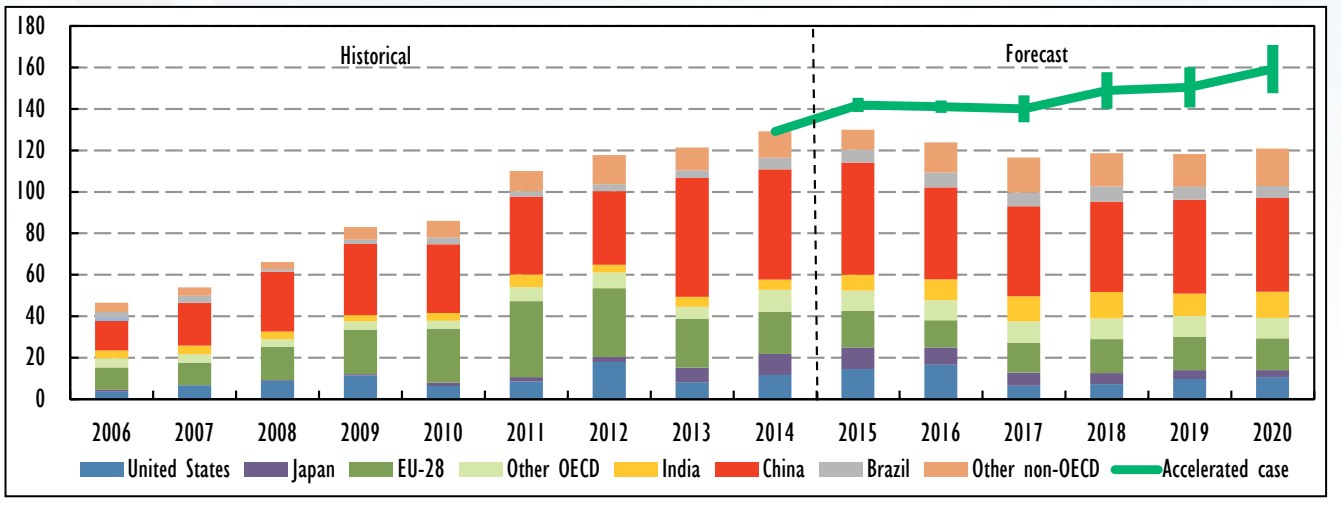
Recent announced long-term remuneration contract prices for renewable power (e.g. preferred bidders, PPAs or FiTS) to be commissioned over 2015-19



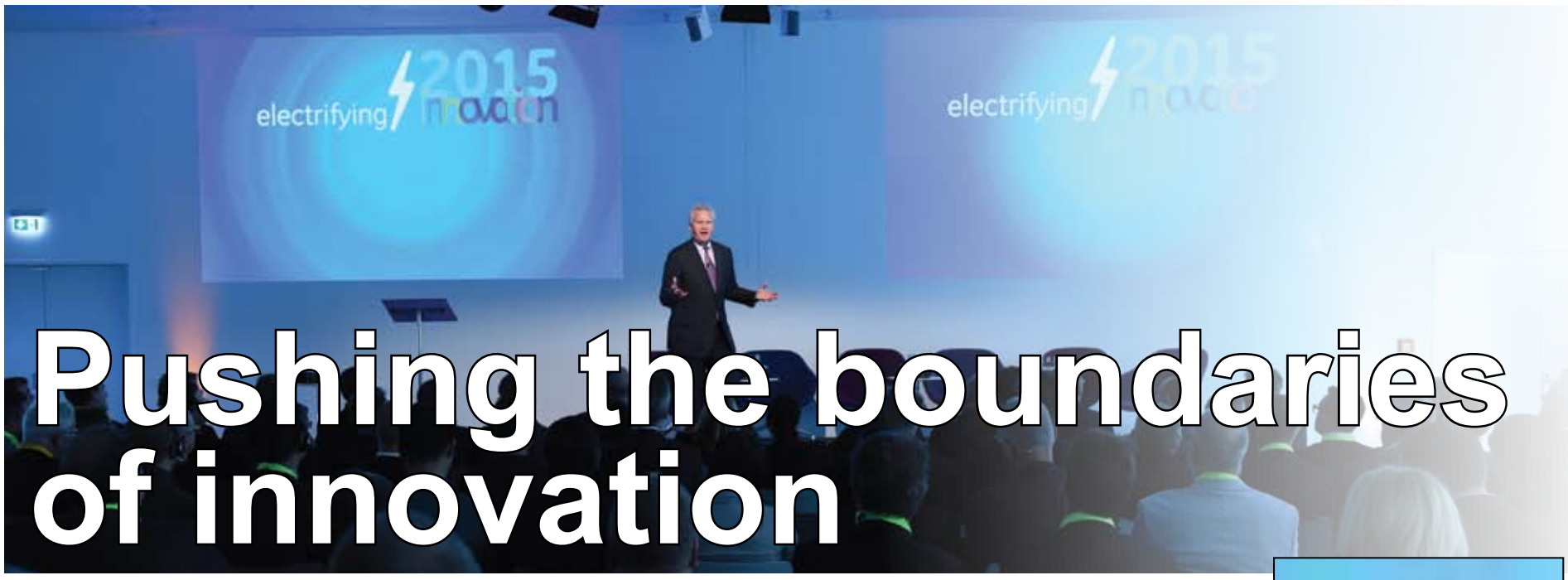
World renewable generation and forecast (TWh)



Renewable power net additions to capacity under main and accelerated cases



Source: Medium-Term Renewable Energy Market Report 2015: Market Analysis and Forecasts to 2020. © IEA/OECD



Pushing the boundaries of innovation

On the occasion of the opening of its Global Technical Learning Centre in Berlin, GE and thought leaders from the global power industry came together to discuss innovations in areas ranging from the Industrial Internet, to energy storage and the importance of power conversion.

Junior Isles

Jeff Immelt, GE's CEO and Chairman, is convinced the future of the power business is about technology and business model innovation. Opening GE Power Conversion's recent 'Electrifying Innovation 2015' event in Berlin, he said: "You have to be willing to drive both technical innovation and business model innovation in order to be successful."

Although Immelt has been 33 years at a company with a long industrial heritage, he is savvy enough to realise the world is changing. In recent times, a big focus within the company has been on what he identifies as the intersection between the physical world and the analytical world, or the Industrial Internet. Immelt believes that every industrial company today has to be a software company and says that making the transition from an industrial company to an industrial-digital company "is critical" to GE's future.

Immelt explained that information and software has to be fed into the company's infrastructure so it can become more effective. By way of example he said: "A gas turbine today has around 500 sensors that receive data continuously. This data can be modelled to drive things like better fuel efficiency, lower emissions and better asset optimisation.

"We are investing massively so we can harness this data; we're building operating systems for our customers to use in order to deliver better customer outcomes."

Achieving this requires merging the "physics and analytics" around every product. "Every one of our products has a 'digital twin' that can be used to optimise its performance. We now have an analytical signature for every product," he said.

Just days after Immelt's Berlin address, GE formally introduced a technology that can create a virtual digital twin of an industrial power plant complex. A digital twin is a collection of physics-based methods and digital technologies that are used to model the present state of every asset in a "Digital Power Plant" or a "Digital Wind Farm". The software and hardware system is powered by GE's Predix platform, which GE calls "the operating system of the Industrial Internet".

According to GE, the technology enables utilities to monitor and manage every aspect of the power generation ecosystem to generate electricity as cleanly, efficiently and securely as the global economy and environment now demand with "unprecedented" real-time control and precision.

The expected benefits include up to $230 million for a new combined-cycle gas power plant and up to $50 million for an existing combined cycle gas-powered plant in savings. Across the power industry today this will equate to up to $75 billion in savings, GE predicts.

US generating company, Exelon Generation is one of the first movers in deploying GE's Industrial Internet solutions. It will implement a Predix-powered suite of enterprise-wide software technologies across three fuel sources – nuclear, gas and wind. According to GE, these solutions will enable Exelon to enhance its performance, efficiencies and reliability.

But it is Europe that GE sees as key to its transition and a centre for innovation. Immelt's opening address in Berlin was held at the official launch of its new Global Technical Learning Centre. He said the decision to open the centre in Berlin is evidence that GE has "underwritten" Europe as "the innovative market".

Certainly Europe has had to innovate and will need to continue to do so as the power industry changes to accommodate the growing amount of renewables being deployed as one tool for combatting climate change.

The Berlin gathering of global business representatives, thought leaders as well as small and medium sized companies heard Jean-François Gagné Head of the Energy Technology Policy Division of the International Energy Agency talk about the cost-effective solutions to go from how energy is used today to how energy services will need to be delivered in the future in order to meet climate goals.

He noted that "we are under utilising" the potential technology has to make the transition cost-effective. "There is tremendous progress happening in renewables and its ability to become a mainstream technology," said Gagné.

Joachim Rumstadt, Chairman of the Management Board of German utility STEAG GmbH, focused on the evolving energy market and renewables. Germany typifies a market in transition. Indeed, having created the word *Energiewende*, it is seen by many as a test case of how far and how fast traditional energy production markets can be transformed.

Rumstadt pointed out that the expansion of renewables in Germany should see demand for renewables reach between 40 and 54 per cent by 2025 and 55-60 per cent by 2035.

With this in mind, Rumstadt said that ensuring reliable, economical and environmentally compatible energy supply is "one of the biggest challenges of the 21st century". He therefore said the focus must be on making renewables viable in what is a rapidly changing energy production landscape.

"The growth of electricity generation from renewables in Germany has increased by more than 150 per cent over the last 10 years. In 2013, 560 GW of generating capacity was installed globally, with around 335 GW of capacity installed in the EU. More than 35 GW of wind energy and 39 GW of solar PV was installed worldwide. A variety of funding programmes such as the EEG in Germany has made this growth possible," he said.

"However, currently the market for renewables energy is in a transitional phase, characterised by a high degree of uncertainty, especially with regard to political and regulatory frameworks."

He stressed, however, that the sustainability of renewable energy essentially depends on how reliable it will be in the future. "Reliability is not limited to the regulatory and legal framework. The reliability of renewables itself must also be considered," noted Rumstadt.

Highlighting the challenges related to keeping the electricity system stable, Rumstadt said STEAG was co-operating with GE on energy storage.

Storage is indeed becoming increasingly important for Europe and other parts of the world. GE Power Conversion is therefore investing in a number of different energy storage technologies.

The company believes the key innovations will come in the area of battery storage. During a press roundtable, one speaker noted that although storage is expensive at the moment, it can add real value in places like Africa when it is used in conjunction with solar PV to help reduce dependence on expensive peaking diesel generation.

While the cost of battery storage will come down with scale and volume, Francesco Falco, Global Sales Leader, GE Power Conversion said that from an efficiency standpoint there are two other important components. "One is the converter or inverter technology," he said, "and the other is the system integration capability. Having the right level of redundancy in the system is extremely important and this is where GE is trying to differentiate from other players in the market."

The economic viability of renewables such as solar will also hinge on developments in the field of inverters, especially as subsidies are phased out.

GE says the next stage of development is the use of silicon carbide in a range of power electronic devices such as inverters to improve efficiency and power density. The company has been investing in R&D related to the material for some time as part of its programme to develop technologies, which may be 10 or 20 years in the future.

Immelt told delegates that making the transition from an industrial company to an industrial-digital company "is critical"

"We started investing in the technology around 10 years ago and it is now finally ready to be used and deployed," said Falco. "We are working on how to apply it across the board because the benefits are everywhere. Fundamentally it's a different and better material to use when building power electronics for things such as drives or converters."

He noted that the use of silicon carbide in solar inverters is a particularly good application. Depending on the application Falco says using the material in power electronics can reduce losses by about half.

The Berlin conference marked the appointment of Stephan Reimelt as President and CEO of GE's Power Conversion business. His predecessor, Joe Mastrangelo, is now President and CEO of GE Power Generation Products.

In closing the conference, Mastrangelo said: "We are now at a crossroads in terms of where the industry is headed. Efficiency is the most important thing in order to achieve our goals… Fuel cost is at an all-time low and in a market where you have renewables and the fuel is free, you wonder where the efficiency will come from. Power conversion is the technology that drives that efficiency."

A big step for offshore wind integration

Cutting the cost of energy is crucial for the offshore wind industry. In October, Siemens presented journalists with some details on its plan for making future offshore connections cheaper and faster. **Junior Isles reports**

For the last decade or so, offshore wind has been a tremendous success story, especially in Europe, which accounts for more than 90 per cent of global offshore wind installations. According to the European Wind Energy Association, Europe's offshore wind capacity now stands at 8045 MW, up from a mere approximately 700 MW in 2005. The Global Wind Energy Council forecasts that by 2020, offshore wind will represent about 10 per cent of global installed capacity.

Yet despite the impressive growth, the industry recognises that if offshore wind is to play a significant role in the future generating landscape, the levelised cost of electricity (LCOE) has to come down significantly. The aim is therefore to cut costs from around the current approximately €0.15/kWh to less than €0.10/kWh by 2020.

As wind farms move further offshore, one of the main challenges is their economical connection to the mainland grid. At a press conference in Bremerhaven, Germany, in October, Siemens revealed details of a development that looks set to have a significant impact on reducing connection costs.

Due to its low losses over long distances, HVDC cables are the technology of choice for transmitting power from far offshore wind farms back to the mainland. In the existing approach, AC output is collected from the wind turbines via small AC offshore substations (OSS) and fed to a large central HVDC converter platform. Here it is converted to DC so it can be transmitted via HVDC cable back to the onshore substation, where it is then converted back to AC.

Siemens has already successfully commissioned four of these offshore DC connection projects. Installing the large central HVDC platforms, however, is no easy task. Weighing some 26 000 t, and covering the size of a football pitch, towing them out to sea and installing them is both costly and time consuming. Further, there are only two vessels in the world capable of lifting and putting them in place.

Based on the deployment of its existing voltage source converter (VSC) HVDC platforms, Siemens is therefore developing the next generation of offshore grid connection platforms for far offshore wind farms. The basic idea is to use much smaller distributed DC platforms, which are connected in series by a DC cable and then via HVDC cable to shore. This eliminates the need for a large central HVDC platform.

Explaining the philosophy behind the move, Dr. Jan Michael Mrosik, CEO Energy Management Division, Siemens AG said: "Projects have been implemented but with a number of painful experiences in the past. So we looked back and asked: how can we optimise our technology to make these projects cheaper and faster?"

Cutting costs in this area is important. Of the four main cost factors impacting the LCOE from offshore wind – turbines, foundations, connections and operation and maintenance – the connection is a very important part. According to Siemens, the DC connection can account for as much as around one third of the overall investment in an offshore wind project. By Siemens' calculations, the new grid access technology could reduce the cost of the offshore part of the connection by around 30 per, which in turn would see the LCOE fall below €0.13/kWh.

Siemens engineers first began investigating possible solutions to the problem about three years ago and came up with a list of about 40 ideas before finally settling on its solution. The core of the new transmission technology consists of a diode rectifier unit (DRU), transformer and smoothing reactor, all combined in one tank.

Peter Menke, Product Portfolio Manager, Siemens Grid Access Business recalled: "We looked at the pros and cons of every proposal. The beauty of the rectifier approach is that on one hand it makes the grid connection simpler and on the other, does not require any hardware change in the turbine."

This was a paradigm shift in approach to grid connections. Menke, explained: "The wind industry has an onshore AC heritage. So turbine controls were designed with the thinking that an offshore AC grid behaves the same as an onshore AC grid but the two are different… We had to develop a turbine control that was tailor-made for offshore grids and reduces the complexity of the HVDC converter."

Fortunately, Siemens was able to draw on experience from a comparable challenge. A factory in Saudi Arabia, which has a 60 Hz grid, had used 50 Hz diesel gensets to run equipment. It managed to replace the gensets with several parallel electronic power converters to establish a 50 Hz grid in the factory and thus eliminate the need for gensets. Separate academic studies had also verified the feasibility of a turbine control system feeding into a rectifier.

This allowed the team to confirm the feasibility of the solution in a very short time. Menke noted that the rectifier also brings another benefit from the turbine perspective. "The behaviour of rectifiers are predictable and diodes are proven, simple components. However, it was the first time the smoothing reactor, transformer and rectifier were integrated in such a manner, so engineering work had to be done."

The HV equipment is fully encapsulated. Notably, for the first time Siemens is using a biodegradable ester, a type of "synthetic vegetable oil", in the DRU to insulate HVDC equipment. Siemens built on the experience gained from a 420 kV level AC power application last year in a power transformer at the Bruchsal substation in Germany. Compared with mineral oils, these are not only more environmentally friendly but are also flame-retardant.

In the current design, each platform will consist of two 200 MW submodules. However, Siemens points out that this sub-module and platform size is not set in stone and could change according to feedback from the market.

The new platform will be significantly smaller, lighter and faster to build. According to Siemens its topside volume will be 80 per cent smaller and topside weight will be reduced by 65 per cent. The platforms can also be built in just 28 months compared with about four years today.

Another key point in the development is that the power handling ability of each platform is sized at 400 MW instead of 900 MW, as is the case for the existing central DC platforms. Up to three can be connected and platforms can be added as the wind farm size grows, thereby optimising capital investment.

Although there are a number of far offshore projects under way or in the pipeline, it is not yet known when the new grid access technology will be deployed on a commercial project. At the moment, the DRU modules are currently in the type approval process. Testing of the valve stacks has started and Siemens plans to assemble and test a complete unit next year.

Certainly, the next few German offshore installations will not benefit from the development. Siemens noted that the technology and the legislation surrounding it would not be ready in time for Dolwin 6, for example, without jeopardising the deadline. It could, however, be considered for UK projects such as Dogger Bank, Hornsea 2 and other Round 3 projects currently in the pipeline.

Dr. Patrick Weber, Head of Grid Access, Business Unit Transmission Solutions, Siemens AG, Energy Management Division, noted: "We have had meetings with Statoil, Stakraft and Dong but talks are in the very early stages, more at the technical level. There were some enquiries following the initial press announcement in Copenhagen in March. But with the ongoing discussions on the Contracts for Difference scheme and which projects will get approval, I don't expect any decision on using the new technology [for UK Round 3 projects] before 2017/18."

Before any commercial projects take place, the plan is for a pilot to be undertaken. "We are trying to realise a pilot system as soon as possible, so we can identify any issues before we scale up and use it in a commercial system," said Dr. Weber.

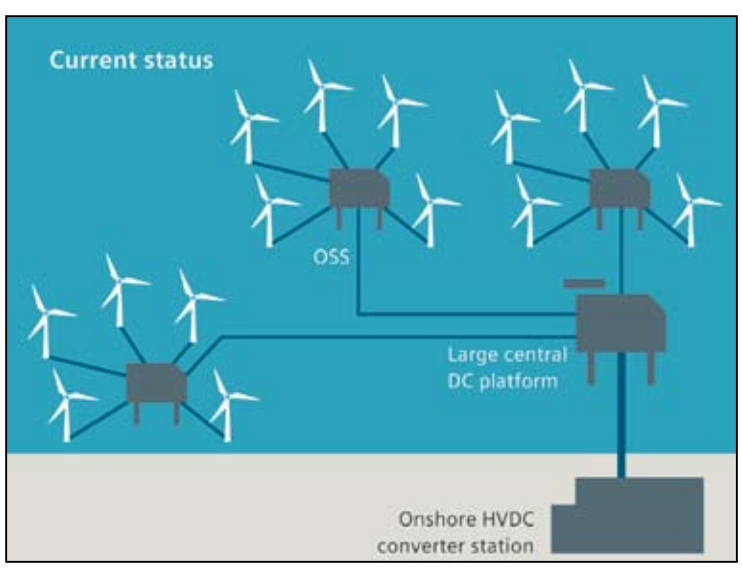
This pilot could possibly be with TenneT, the Dutch-German transmission grid operator responsible for managing the high-voltage grid in the Netherlands and large parts of Germany. TenneT is the grid operator that is most affected by the need to transmit wind power from the North to the South of Germany and handles offshore grid connections in the North Sea. Having commissioned four offshore platforms this year, as part of plans to have 7.1 GW of offshore wind connected by 2019, TenneT welcomed the new development.

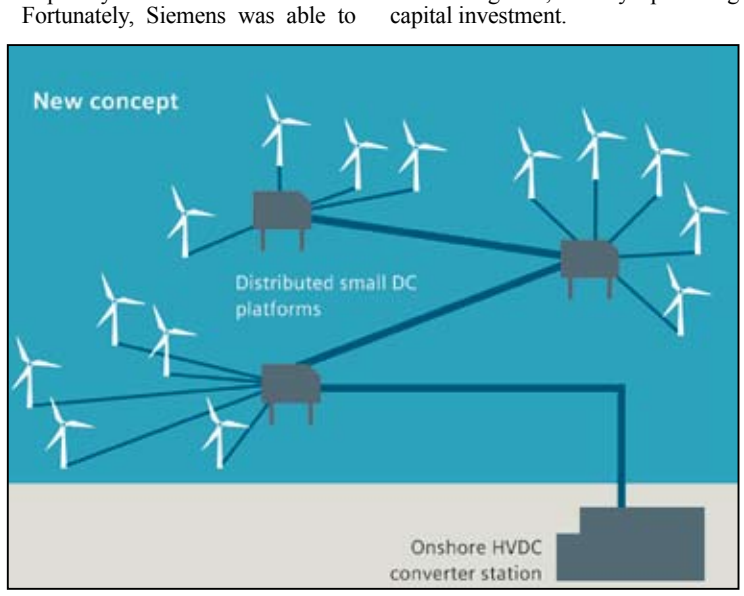
At the press launch Wilfried Breuer, Member for the Tennet Executive Management said: "We welcome this innovative solution. It will help make offshore wind viable for the future so that it can make a major contribution to energy generation in Germany. It will also make it affordable for the end consumer."

If this technology, along with other industry developments is successful in reducing the LCOE from offshore wind, it could lead to Germany and other countries increasing their offshore wind ambitions.

Dr. Weber concluded: "Germany's ceiling on the amount of offshore wind was really motivated by the cost situation. If we are able to bring down the LCOE faster than the government expected, politicians may rethink the cap of 15 GW by 2030. Lowering costs might bring some room for manoeuvre, politically, so offshore wind can be developed more aggressively than the planned roadmap."

The new DC grid access solution is based on distributed transformers and diode rectifiers located on small, distributed DC platforms and connected in series by a DC cable. A large central DC transmission platform is not required





Getting smart about frequency control

Battery storage has many applications, one of which is to provide frequency regulation in transmission networks. EDF has recently installed a battery-based system to test its operation under grid conditions. **Junior Isles**

In most of today's power systems, frequency control is provided by generating capacity. A more efficient option could be to use utility scale battery storage. In June this year, Electricité de France (EDF) began operating a smart battery energy storage system (BESS) to test battery storage in real conditions.

Under a contract signed by an Alstom-Saft consortium last year, a 1 MW/30 min BESS has been installed at the Concept Grid Lab located on EDF's research site at Les Renardières, south of Paris (Seine-et-Marne region). It marks the first demonstration launched by EDF on a megawatt scale for frequency regulation using a lithium-ion battery storage system.

Frequency is an indicator of grid stability; it represents the balance between energy produced and energy consumed. To maintain this balance (and therefore the frequency), the operator uses the energy available through the primary reserve, mainly ensured by thermal or nuclear power plant operators, by blocking part of their production capacity.

This primary reserve is an amount of power delivered to the grid automatically and proportionally to the frequency deviation. This reserve is fundamental to maintain the grid stability in case of a sudden generation drop. At the European level, it represents 3000 MW and about 600 MW of this reserve is provided by France. The full amount of the primary reserve must be available in 15-30 seconds. The primary control reserve in Europe is essentially sized to cover the loss of two major power plants (i.e. 3000 MW).

The potential for battery storage to take the place of primary reserve is huge – given the right incentives. A study prepared for the US Department of Energy by Pacific Northwest National Laboratory (PNNL) showed that in the case of California the use of batteries could reduce the need for primary reserve by 40 per cent. This could be valuable in Europe, where batteries could help to compensate for the loss of generating capacity.

Battery storage systems provide producers and grid operators with more flexibility over the energy supply that is immediately available. In the event of an imbalance between production and consumption, the storage system can either release energy into the grid or store it in a few hundred milliseconds, thus controlling the frequency of the network. This is much faster than conventional generating capacity.

Commenting on the EDF project, Alstom's Conversion Solutions Director, Davy Theophile said: "EDF wanted to understand how battery storage could be configured for frequency regulation particularly for two cases: firstly to see how storage can contribute to areas on the French mainland where there is a lack of generating assets to support the grid; and secondly, to extrapolate these results in the grid serving islands."

As leader of the project, EDF performed all the modelling – for both the technical and the business case. Theophile noted: "Establishing a viable business model is at the centre of the large deployment of battery energy storage. In addition to technical feasibility, EDF also wants to validate its business model for replacing a part of the primary reserve from conventional power plant by battery storage."

Pre-qualification for the project was started in mid-2012, with Alstom being shortlisted as the technology provider and ultimately signing the contract in 2014.

Under the contract, the Alstom-Saft consortium delivered a BESS consisting of Alstom's MaxSine e-Storage smart converter and Saft's Intensium Max 20 lithium-ion battery.

The systems are housed in two separate 20-ft containers at the EDF site. The first contains the Saft Li-ion battery. It is composed of 4500 elementary 3.6 V cells, assembled in series and parallel. The full nominal voltage is 700 V DC. When fully charged, the battery is able to provide 1 MW for 30 min, corresponding to an energy of 500 kWh.

The second container houses Alstom's inverter. It converts the 700 V DC to 700 V AC, which is then stepped up to 20 kV through a transformer. MaxSine eStorage is a power conversion system with power electronics and real-time control software that interfaces batteries to the electrical network. It converts electricity between direct and alternating current, which can be stored or released into the grid. Alstom's MaxSine eStorage real-time energy storage management software allows electricity production to be optimised according to the grid's needs.

One of the main challenges was how to adapt Alstom's converter system to allow integration of certain EDF regulation loops.

Theophile explained: "We have a regulation loop inside our system for frequency regulation. EDF wanted to use its own regulation loop and wanted us to ensure it could work in our control system. The first task was clarification of the design of the interface between EDF's system and our control system, and then manufacture the equipment."

Work began at the end of March 2014 and the system was delivered at the end of November. The system took just two weeks to install and commission and was ready for operation just before Christmas, allowing testing to be performed throughout January.

Alstom says its system is "agnostic" in terms of which battery technology it can be used with. But the decision to partner with Saft was influenced by a recent collaboration where the two companies delivered a 1 MW BESS for EDF's Nice Grid Project (see *TEI Times* May 2014). That project used lithium-ion technology for peak demand management and the integration of intermittent solar energy.

Commenting on Saft's involvement in the Concept Grid project and Li-ion technology, Michael Lippert, Marketing and Business Development Manager, Energy Storage Business Unit, Saft Batteries, said: "Our technical proposal was convincing, i.e. the technology responds to their needs in terms of power, charge dynamics, energy efficiency and lifetime.

"Secondly, we were able to interact with both Alstom and EDF on the project as more than just an equipment supplier. Using storage to provide frequency regulation is new for EDF; they needed someone with a deep understanding of the battery functions and needed someone that could respond if they needed to change operating patterns etc."

He also noted that a Li-ion battery has two or three important characteristics, which, when taken in combination, make it ideal for this application. It is a high-power device that has the ability to be charged and discharged quickly; has a good calendar and cycle life (achieving more than 10 years of operation with very frequent charge/discharge cycles), which is important in this application; and has high energy efficiency. It is also a mature product.

Testing of the system will be conducted in two phases. The first will be at the Concept Grid, which is a dedicated network that allows EDF to test different scenarios in terms of stress on a network when different assets are connected to the grid. The system will run 24/7 and be tested under different grid configurations, with tests running until around mid-2016.

The BESS will then be re-located to another site later that year to begin the second phase of testing. The exact location has not been decided but it will be near a power plant to see how the energy from the battery can replace that from the power plant for frequency control.

Frequency regulation is expected to be a major driver for battery-based energy storage in the future due to its fast and accurate response. It will no doubt help the business case for the technology.

This has certainly been the case in California. Two thirds of the 62 MW of storage deployed in the US in 2014 was located in PJM territory, where the market was re-structured a few years ago to provide better payments for fast-ramping energy storage resources.

Many industry observers and battery suppliers believe the ability of batteries to provide other services in addition frequency regulation, could deliver several value streams that make the technology attractive going forward.

As more renewables are integrated into the electricity system, batteries will not only allow storage of energy when wind and solar are not available but will also help smooth the grid frequency fluctuations caused by intermittent renewables.

While the prospects are promising, it is widely acknowledged that the regulatory frameworks, particularly in European countries, will have to be adapted for the full potential of energy storage to be realised.

Nevertheless, proponents remain confident. Lippert concluded: "I believe that performing frequency regulation services using storage systems that have other primary functions is something that we will increasingly see in the coming years. Energy storage will be important for providing the flexibility that will be needed in the electricity system."

The systems are housed in two separate 20-ft containers at the EDF site. The first contains the Saft Li-ion battery; the second houses Alstom's inverter

Don't drop the baton

Junior Isles

You don't have to be an avid churchgoer to have heard the saying "…The race is not to the swift…" [Ecclesiastes 9:11] and indeed sometimes it isn't; outcomes are also coloured by chance, as in a sprint relay.

Yet with COP21 fast approaching, now is the time for both speed *and* a safe pair of hands.

As the Bonn sessions on climate change concluded in late October, the general consensus was that although good progress was made, fundamental issues still need to be resolved in the little time remaining before the meeting in Paris.

Dr Stephen Cornelius, WWF-UK's chief adviser on climate change said Bonn had been "a tough week for the negotiators" but he was now more hopeful. "The Bonn climate talks have provided the options we need to take to Paris but countries will need to continue to work over the next five weeks to get the strong deal we all want and need."

Ministers will now begin to examine the text at the pre-COP, taking place on November 8-10 in Paris, before the discussion moves to COP21 on November 30.

Immediately following the meeting of climate negotiators in Germany, Jennifer Morgan, Global Director, Climate Program, World Resources Institute, said: "Negotiators made some significant strides here in Bonn but a much more vigorous pace is needed to secure a strong climate agreement in just a few weeks. We've been running a marathon for years to reach to this point. Now we need an all-out sprint to get over the finish line in Paris."

The journey to the UN's 21st Conference of the Parties on climate change has certainly been a marathon. Since the failure to achieve a global climate change agreement in Copenhagen in 2009, politicians have been bogged down in often unproductive talks on how they can come up with an agreement that is palatable to both developed and developing countries.

Meanwhile the door on action needed to stay below the 2°C rise in global temperature is rapidly closing.

> Finance remains the "elephant in the room", both for funding climate actions before 2020 and after 2020 when the elements of the new deal come into force

Experts often point out the need for urgent action against a backdrop of evidence of the effects of climate change. Professor Sir David King, the UK's Special Representative for Climate Change and previously the government's Chief Scientific Advisor, described 2015 as a seminal year for the planet.

Speaking at the RenewableUK conference in Liverpool, UK, a couple weeks before Bonn, Sir David noted that 2003 was the hottest year on record and stressed that this would be the average summer temperature in 2050 in central Europe.

"In 2003 there was the biggest natural disaster in central Europe on record in terms of fatalities – the number of people who died was estimated at about 50 000… That's the challenge of climate change… the bad news is there's a gap between striking the blow – between the pathway we're on now and the pathway we need to be on."

Sir David believes that "after 21 years, we will finally get an agreement" in Paris. "We have most of the Intended Nationally Determined Contributions (INDCs) in, which means we can now analyse which pathway we're on."

Analysis shows, however, it is not the pathway we need to be on. "When we add up all the contributions we're going to find that we are still on track for a 3.5°C world," said Sir David.

One of the first big jobs facing leaders when they arrive the Paris will be how to close the gap between the emissions countries have promised to cut, and what is needed to limit global warming to well below 2°C

In order to keep warming under the 2°C threshold, experts call for global emissions to peak before 2020 and decline rapidly thereafter. National climate pledges submitted to the UN by more than 150 countries fall short of the global effort needed to avoid the worst effects of climate change.

The International Energy Agency (IEA) recently released a World Energy Outlook (WEO) special briefing that outlines the energy sector implications of national climate pledges. The briefing finds that if all countries meet the goals outlined in their submitted INDCs, growth in energy-related emissions – which account for two-thirds of total greenhouse gas emissions – will slow to a relative crawl, but only by 2030.

The WEO special briefing finds that all of the INDC submissions take into account energy sector emissions and many include specific targets or actions to address them. If these pledges are met, then countries currently accounting for more than half of global economic activity will see their energy-related greenhouse gas emissions either plateau or be in decline by 2030.

A separate report also notes that the INDCS fall short of the science-based and equitable global effort needed to avoid the worst effects of climate change.

The analysis, 'Fair Shares: A Civil Society Equity Review of INDCs', is an independent review supported by WWF and a diverse group of civil society organisations, social movements, trade unions and faith groups.

The analysis in the report measures the fair share of climate effort that each country should be responsible for against their level of responsibility and capability, and finds that some countries have contributed their fair share of effort but others have not.

Clearly the actions and pledges by countries will have to be reviewable going forward and financing will have to be provided for developing countries to intensify their actions to close the gap.

Financing will therefore be the other major stumbling block in Paris. According to the IEA special report, full implementation of the pledges will require the energy sector to invest $13.5 trillion in energy efficiency and low-carbon technologies from 2015 to 2030, an annual average of $840 billion.

After the Bonn meeting the WWF noted that finance remains the "elephant in the room", both for funding climate actions before 2020 and after 2020 when the elements of the new deal come into force.

Worryingly, a section of the draft UN climate deal ballooned from 12 paragraphs to 2.5 pages, as details of the financial assistance developing countries will receive from the developed world were included.

Developing nations claimed the deal had been "hijacked" by developed countries when it was reduced from 89 pages to just 20 a few weeks ahead of the Bonn talks.

Finance is central to the success of an agreement, as poorer countries say they will need funds to adapt to future extreme weather events, funds to mitigate carbon emissions by using clean energy and funds to invest in early weather warning systems.

Tasneem Essop, WWF's head of delegation to the UN climate talks commented: "Political leaders need to provide the scale of support – including finance and technology – that will catalyse the just transition to a safer and renewable energy world. Additional support for poor and vulnerable countries is a critical element of a new deal."

She added: "We know that finance is left to the last moments of negotiations and used as a bargaining chip. But governments need to know that this last moment is now."

Martin Kaiser, Head of International Climate Politics at Greenpeace, likened this approach to a card game. "Everyone wants to play their cards late. But not everyone can have the ace of spades. This process is too important to be a high-risk poker game. They need to put down their cards, and play together as a team."

As the UN climate talks concluded in Bonn, the WWF said "the baton passes to political leaders" to resolve key issues standing in the way of finalising a new global climate deal.

Let us hope they are up to the task. The clock is ticking and what could be classed as 'the Final' is almost here. Now is not the time for marathon mentality or the dropping of batons. It is time for political leaders to follow through, with speed and precision, on the work the rest of the team has put in during the 'qualifiers'.

Think Jamaica, 4x100m relay.