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Special Project Supplement

Construction is well under way on what is being hailed as one of Europe's most efficient coal fired power plants.

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Bonn makes slow progress towards climate deal

WWF's Samantha Smith said what happened in Bonn "was big" but work needs to speed up to avoid the worst impacts of climate change

Progress was made during the latest round of climate change talks in Bonn, but negotiations need to be speeded up if there is to be a global agreement in Paris. **Junior Isles**

UN climate negotiations made slow but steady progress in Bonn, Germany, last month.

For the first time, all countries signalled that more ambitious emissions cuts are needed in the next five years. But with only 10 more formal negotiating days scheduled before the COP21 meeting starts in Paris on November 30, many believe that progress is still too slow.

Samantha Smith, leader of WWF's Global Climate and Energy Initiative, said: "What happened in Bonn was big. After difficult negotiations, all countries have said that more ambitious, immediate emissions cuts are needed and these commitments must be a clear outcome of the Paris talks. However, that work needs to speed up too if we are going to avoid the very worst impacts of climate change.

"This is also critical because the gap is growing between what is needed and what is being promised on finance and emissions. Nonetheless, we see signs that governments are finally committed to take more action on emissions prior to 2020."

The meeting, attended by government officials from more than 200 countries, made progress on dealing with the gap between what is needed to avoid dangerous climate change and current commitments to cut emissions. All party blocs covering the five regional groups came forward with proposals on how the emissions gap can be closed and all called for a decision on this issue at the Paris climate negotiations.

Calling for much stronger mandates, the WWF said, however, that countries must be ready to start real negotiations in August when the climate talks reconvene.

In Bonn, countries reorganised and partly streamlined the lengthy draft text. This will make it easier for ministers to provide a political steer to their negotiating teams. WWF said ministers must now prepare thoroughly "as there is no excuse for avoiding real negotiations" in the August session.

Some observers, however, were disappointed with the final outcome. The main goal for the two-week session in Bonn was to shorten the negotiating text, which included proposals to reduce greenhouse gas emissions, scale up renewable energy development and improve access to climate finance for developing countries. Negotiators, however, only managed to trim the 90-page document by five pages.

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Businesses looking for bigger role in climate strategy

Businesses are attempting to play a bigger role in formulating climate change strategy.

Ahead of last month's climate change talks in Bonn, six European oil and gas companies called for a global price on carbon.

In a letter to French foreign minister Laurent Fabius and UN climate chief Christiana Figueres, the chief executives of Royal Dutch Shell, BP, Eni, Total, Statoil and the BG Group said carbon markets should be introduced around the world and eventually linked into an international system.

In the letter published in the *Financial Times*, executives said: "We owe it to future generations to seek realistic, workable solutions to the challenge of providing more energy while tackling climate change."

The Climate Group saw the move as a "symbolic moment" that demonstrates an important if not universal shift.

Mark Kenber, CEO of The Climate Group, said: "We're seeing businesses apparently taking a lead in policy and innovation. What many companies have been saying is that a clear, transparent framework will help them be confident in making long-term plans and investments, and this latest initiative reiterates that.

"We believe businesses across the board have a key role to play in supporting a strong low carbon economy, and would therefore encourage them to support calls for action and strategies for decarbonisation of the economy."

Kenber said the letter reflects a growing realisation within influential sectors of the fossil fuel industry of a need to adapt to both market and climate realities.

The six European companies said that eliminating the use of coal for power generation in favour of cleaner burning natural gas, a large source of their income, would dramatically cut carbon emissions.

They claim the best way to promote climate-friendly investments is for more governments to introduce carbon pricing mechanisms, such as the EU emissions trading system, and create a global framework connecting national or regional schemes.

Jan Ahrens , Director, Market Analysis at ICIS commented: "The statement clearly shows that companies are not afraid of carbon pricing mechanisms in general. The key issue for global players is uncertainty about the future developments and fragmentation. Uncertainty is especially a problem when long-term investment strategies are taken, while fragmentation influences significantly international competitiveness of companies and the risk of carbon leakage. A global carbon price would most likely handle both problems effectively."

Some environmental groups, however, were suspicious of the letter. Greenpeace called it a "smokescreen," and noted that the role carbon markets will play in the Paris agreement is still unclear.

"In the long term, they have the wrong business model. And that's something they have to acknowledge," said Martin Kaiser, a Greenpeace climate policy expert.

Last month also saw 80 UK companies send an open letter to Prime Minister David Cameron, which among other things called for the new government to establish a long-term framework for investment in the low-carbon economy. This, they said, would give industry much needed clarity over what is expected in terms of low-carbon development, and boost the confidence of green investors.

Alistair Phillips Davies, Chief Executive of UK utility SSE, said: "As one of the UK's largest investors in low carbon energy, SSE has long argued for a strong international carbon framework that can provide the right signals for efficient investment."

Continued from Page 1

Just days before the conclusion of the Bonn meeting, leaders at the G7 Summit in Elmau led by German Chancellor Angela Merkel, had made a firm commitment to "decarbonise" the global economy over the course of this century.

Some officials at the Bonn meeting said the outcome of the climate talks did not live up to the call made by the G7.

"Unfortunately, we are still a long, long way from where we hoped to be," said EU delegate Ilze Pruse. "We must go faster."

Others also argue it would be impossible to reach a deal in Paris until negotiators ended procedural debates and began addressing the difficult issues hampering the talks.

Yvo de Boer, the former top UN climate official said: "It's like knitting socks and starting at the toes: you don't know if you'll end up with ankle socks, knee socks or tights."

The EU and many small island states say the Paris agreement must be legally binding or there is no point in having a global climate deal.

This is likely to present a problem for several countries, including the US. President Barack Obama's administration supports a deal in Paris, but is wary of one with legal obligations requiring approval in a US Senate that is dubious of international treaties.

US President Barack Obama's administration supports a deal in Paris

At the opening of the 11-day meeting in Bonn the French foreign minister Laurent Fabius warned that any global agreement to cut greenhouse gas emissions would have to avoid needing approval from the US Congress.

Fabius said: "We know the politics in the US… Whether we like it or not, if it comes to the Congress, they will refuse."

A binding global limit on carbon emissions is expected to be reached in Paris and under US law, any international deal must be ratified by Congress.

The current Republican-dominated Congress has opposed federal action to address climate change and administrative action, including the proposed Clean Power Plan, has met legal challenges.

One possible outcome in Paris is a deal in which some elements are binding but not the emissions targets set by individual countries.

The Obama administration has pledged to reduce US emissions by 26-28 per cent below 2005 levels by 2025.

Jennifer Morgan, a climate policy expert at the World Resources Institute, said it was encouraging that Fabius was raising the legal issue now so it can be dealt with before the Paris conference.

"It's a sign that he's really pushing countries to come to terms with what the agreement can and cannot be," she said.

Peak in GHG emissions can be achieved by 2020, says IEA

The prospect of achieving an early peak in greenhouse gas emissions could be a key driver in reaching a climate change agreement in Paris.

Junior Isles

A peak in global energy-related greenhouse gas (GHG) emissions could be achieved as early as 2020 and at no net economic cost, according to the International Energy Agency (IEA).

In its new 'World Energy Outlook Special Report on Energy and Climate Change', the Paris-based agency says that achieving an early peak is one of four key pillars needed to make UN climate talks in Paris a success.

A peak in global energy-related emissions could be achieved as early as 2020 if governments implement just five key policy measures, as shown in the IEA's "Bridge Scenario". It claims this major climate milestone is possible utilising only proven technologies and policies, and without changing the economic and development prospects of any region.

Two of the measures, which relate specifically to electricity generation are: reducing the use of the least-efficient coal-fired power plants and banning their construction; and increasing investment in renewable energy technologies in the power sector from $270 billion in 2014 to $400 billion in 2030. It also noted that increasing energy efficiency in the industry was crucial.

Speaking at the launch of the report, Fatih Birol, Chief Economist at the IEA said: "Today in many parts of the world, especially in Asia, we see many inefficient coal fired plants being built. These will run for another 40-50 years and will lock-in CO_2 emissions. The efficiency of these plants could be easily be improved."

He calculated that if inefficient coal fired plants built in the next 15 years can be improved by just 2 percentage points, from 35 per cent to 37 per cent – which is still lower than the best available technology – the emissions saved would be equal to the emissions saved under the EU 2030 targets.

"We are therefore demanding the banning of building inefficient coal fired power plants," he said.

In addition to banning the building of subcritical coal fired plants in favour of supercritical plant, the IEA also said that carbon capture and storage "has to be part of any scenario". Despite there only being a handful of large scale projects in operation, the IEA considered it to be a proven technology.

"We consider CCS to be a proven technology," said Birol, "but of course the economic conditions are very important to see a higher penetration."

The strong growth in renewable investment, said the IEA, would see wind, solar and other types of renewable power overtake coal to become the world's top source of electricity in just 15 years if the pledges countries are making for a global climate change deal this year are met.

Commenting on the IEA report Professor Catherine Mitchell, Professor of Energy Policy at the University of Exeter said: "This report confirms that two absolute no-brainers are cutting energy waste and closing coal fired power stations – each nation should be doing those two things as soon as it can."

In a separate report released just ahead of the IEA report, the London School of Economics (LSE) said GHG emissions in China could peak by 2025, five years earlier than previously estimated.

The authors of the LSE study, including Lord Nicholas Stern and Fergus Green, both from LSE's Grantham Research Institute on Climate Change, said: "The UN climate change conference in Paris later this year will be more successful if governments everywhere understand the extent of change in China and its implications for global emissions."

Pipeline expansions continue even as gas demand slows

- Two new Nord Stream pipelines to be built
- Slowdown in Asia reduces demand forecast

Junior Isles

Gazprom is building a global strategic alliance with energy major Royal Dutch Shell that will include asset swaps and allow the Russian gas giant to penetrate new markets. The news comes as a slowdown in future gas demand is being forecasted by the International Energy Agency (IEA).

Gazprom, the world's top gas producer, said in June that Shell and its long-time gas buyers in Europe – Germany's E.On and Austria's OMV – had agreed to build two new Nord Stream gas pipelines under the Baltic sea to Germany.

Gazprom's Chief Executive Alexei Miller said the two new pipelines would transport an extra 55 billion m^3 of gas, or more than a tenth of Europe's gas demand by the end of 2019.

Miller said the agreement with Shell also foresaw an expansion of the firms joint $20 billion liquefied natural gas plant on the eastern island of Sakhalin.

"Documents of such significance are signed only once every five years or maybe even 10," Miller said on the sidelines of the Saint Petersburg International Economic Forum.

In April Shell agreed to buy smaller rival BG for $70 billion plus debt and Miller said the deal was adding extra potential to cooperation, such as upstream asset swaps between Gazprom and the Shell-BG group.

"The deal will take some time to materialise. Shell for instance needs to become the full owner of BG," he said. "We plan that next year we could sign such a deal in St Petersburg at the same forum."

Commenting on the alliance Peter Kiernan, lead energy analyst at the EIU, said: "The reported decision that Gazprom plans to expand the Nord Stream pipeline is interesting as earlier this year it announced that such plans had been put on hold.

"Gazprom's long term goal of redirecting gas supply to Europe through routes that avoid Ukraine is not new, but has been frustrated by high infrastructure costs, regulatory challenges, and Russia's soured relations with Europe. At any rate any expansion of Nord Stream's capacity would mean a redirection of Russian gas supply to stagnant European markets, rather than additional volumes."

With regard to Sakhalin LNG, he added: "It is clear that Russia seeks to secure a greater foothold in the growing Asian gas market before it is too late, given the amount of forthcoming Australian and US LNG."

In its '2015 Medium-Term Gas Market Report', the IEA noted that weak Asian demand was a factor in slower gas demand than expected.

The annual report, which gives a detailed analysis and five-year projections of natural gas demand, supply and trade developments, sees global demand rising by 2 per cent per year by the end of the forecast period, compared with 2.3 per cent projected in last year's outlook.

"One of the key – and largely unexpected – developments of 2014 was weak Asian demand," said IEA Executive Director Maria van der Hoeven. "Indeed, the belief that Asia will take whatever quantity of gas at whatever price is no longer a given. The experience of the past two years has opened the gas industry's eyes to a harsh reality: in a world of very cheap coal and falling costs for renewables, it was difficult for gas to compete."

Record year of growth for the global solar sector

Solar power had another record year in 2014, according to the latest report by SolarPower Europe, formerly the EPIA (European Photovoltaic Industry Association). Its flagship market report: 'Global Market Outlook for Solar Power 2015-2019' stated that 40 GW was connected worldwide in 2014, surpassing the previous year's record of 38.4 GW

James Watson, CEO of SolarPower Europe commented: "It reveals that the global solar sector reached a cumulative capacity of 178 GW in 2014, multiplying the installed capacity by a factor of 100 in only 14 years of development."

China, Japan and the USA led the world's solar market in 2014, while Europe installed 7 GW, with the UK leading the way – contributing 2.4 GW in 2014.

Watson noted: "The success of the UK, set to be the largest European market again in 2015, reinforces the evidence that solar power is a versatile and cost-efficient energy source in any climate." He added that solar power could grow by 80 per cent in Europe by 2020.

SolarPower says that if the momentum continues, with support from the right frameworks, there could be over 500 GW of solar power capacity installed by 2020.

"SolarPower Europe's Global Market Outlook foresees up to 540 GW of total solar capacity by 2020 in its high-scenario," said Michael Schmela, SolarPower Europe's Executive Advisor. "But even the low support scenario estimates a total solar volume of 396 GW, which would be about twice as much as the capacity installed today."

A separate report released by GlobalData says China will remain the world's largest market for annual solar photovoltaic (PV) installations with slightly over 17.6 GW in 2015.

The report called 'Global Solar Power Market in 2014' states that China will have the single largest share of a global market that is expected to near 43.8 GW by the end of 2015, up from approximately 36.4 GW in 2014.

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European Parliament compromises on ETS reform The European Parliament has backed the introduction of a Market Stability Reserve to boost carbon prices. Page 2

EPA's Clean Power Plan no threat to reliability Concerns that the US Environmental Protection Agency's Clean Power Plan is a threat to the US electric system security are largely overstated, according to two recent independent reports. Page 4

Australia favours solar over wind Government plans to reduce renewable support are a big threat to wind but large-scale solar projects still look promising. Page 6

Shale gas progress falters in Europe The prospects for the widespread development of a shale gas industry in Europe have faltered in spite of attempts by industry and some governments to kick-start exploration. Page 7

Vattenfall restructures Vattenfall is to implement a new organisational structure and executive management team as part of wider plans to review its strategy and address current market challenges. Page 9

Fuel Watch: BP Energy Outlook 2035 Demand for natural gas over the next 20 years will rise fastest among fossil fuels, mainly driven by growing consumption in non-OECD countries. Page 11

Technology: Lünen could answer several utility problems The energy landscape has changed dramatically in recent years with many of Europe's energy companies being squeezed from all angles. A technology to be demonstrated at a pilot project in Lünen, Germany, could potentially answer their problems. Page 15

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EU moves to address energy trilemma

Šefčovič: the Energy Union is "the most ambitious European energy project since the Coal and Steel Community"

The EU's new 'Energy Union' strategy could improve EU energy independence while meeting long term climate goals in a cost-effective manner. **Junior Isles**

The energy industry and politicians have largely welcomed the European Commission's recently published Energy Union strategy.

The Energy Union has been drawn up to set a new direction and a clear long-term vision for European energy and climate policy. It is seen as a fundamental step towards the completion of a single energy market and reforming how Europe produces, transports and consumes energy.

Three key documents were published by the Commission in late February:

- A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy that sets out the overall approach, the measures, the goals of an energy union – and the detailed steps the Juncker Commission will take to achieve it. Among other things it includes new legislation to redesign and overhaul the electricity market, ensuring more transparency in gas contracts; substantially developing regional cooperation as an important step towards an integrated market, with a stronger regional framework; new legislation to ensure the supply for electricity and gas; increased EU funding for energy efficiency or a new renewables energy target.
- An Interconnection Communication, setting out the measures needed to achieve the target of 10 per cent electricity interconnection by 2020, which is the minimum necessary for the electricity to flow and be traded between Member States. It shows which Member States currently meet the target and which projects are necessary to close the gap by 2020.
- A Road to Paris Communication, setting out a vision for a global climate agreement in Paris in December. The vision is for a transparent, dynamic and legally binding framework to ensure fair and ambitious commitments from all parties. The Communication also translates the decisions taken at the European Summit in October 2014 into the EU's proposed emissions reduction target (the so-called Intended Nationally Balanced Contribution, or INDC) for the new agreement.

The documents were published against a backdrop that shows the high

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Plenty to do despite early wrap-up at Geneva climate talks

Climate change negotiators made good progress at a recent climate change conference in Geneva, considered by many to be a success of sorts. However, much of the hard work still lies ahead.

The six-day conference ended last month with an agreement on a formal draft negotiating text for the crucial COP21 summit in Paris in December. It was the first formal climate meeting since the summit in Lima, Peru, in December 2014.

The 86-page document builds on the Lima documents and covers issues ranging from climate change mitigation, adaptation, finance, technology and capacity-building.

Christiana Figueres, Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC), said: "We now have a formal negotiating text, which contains the views and concerns of all countries. The Lima Draft has now been transformed into a negotiating text and enjoys the full ownership of all countries."

Jamsheen Toop, WWF's head of delegation to the UNFCCC noted, however, that while the chairpersons at the Geneva conference "deserve credit for their approach at the session and getting a party-owned draft text agreed, tackling the difficult issues" is yet to begin.

She said "Our perception is that traditional fault lines have not yet been breached. Negotiators face a tremendous task to reach agreement on the contentious issues and iconic Paris deadline to deliver a balanced deal in the two or three negotiating sessions left before meeting in Paris."

She said that the first test of political will and influence inside the negotiating process will come in the period from March to June where countries announce their plans to reduce emissions and, it is hoped, provide financial resources for the post-2020 period.

Ms Figueres said that UN leaders from the UK's three main parties last month took the rare step of signing a cross-party pledge to combat climate change whatever the result of the May 7 general election.

The next step for climate negotiators is to reach consensus on the content of the new climate deal. Formal negotiations on the text will continue in Bonn, Germany in June.

Some of the key issues that are yet to be agreed include how governments can scale up pre-2020 actions, the application of the convention principles related to differentiation and equity, the mitigation ambition in both the pre-2020 and post-2020 periods and ensuring that a new global climate regime provides security for those most vulnerable to climate impacts.

To avoid the most dangerous impacts of climate change, countries have already agreed that the global temperature rise should stay below 2°C (3.6°F) compared to pre-industrial levels. Many want the Paris deal to state more specifically what that actually means in terms of emissions cuts.

Some say the Paris agreement should incorporate the UN climate science panel's finding that to have a two-thirds chance of staying below 2°C the world must cut emissions by 40-70 per cent by 2050. Others want to go further, calling for net zero-emissions by mid-century.

Figueres said it is already clear the combined pledges will not match what countries say is required to avoid dangerous warming, meaning deeper cuts will be needed after 2020.

"What Paris does is to chart the course toward that long-term destination," she told reporters in a webcast briefing.

- Industrial countries taking part in the 1997 Kyoto Protocol on climate change reduced their total greenhouse emissions by around 23 per cent from the 1990 base year at the end of their first commitment period to 2012, far more than they had envisaged, according to the UNFCCC.

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North American states cooperate on energy, climate change

■ Canada announces new emission targets ■ Obama: climate change threatens national security

Siân Crampsie

Canada, Mexico and the USA are to improve their cooperation in the fields of energy and climate change.

The three nations have announced a new partnership and the creation of a working group to collaborate on energy and climate change policy, and enhance related discussions and negotiations on key issues.

The agreement brings a new impetus to climate change and energy-related issues ahead of December's international climate talks in Paris. It came just a week after Canada announced new emissions targets for 2030, while President Barack Obama said that climate change was an "indisputable" threat to national security.

The agreement between the three nations does not include binding targets but will focus on clean energy technology development, reliable and low-carbon electricity grids, and strategies to limit greenhouse gas emissions.

Canada and Obama's US administration have clashed in recent months over the proposed Keystone XL pipeline that would connect the oil sands region in Alberta, Canada with the Gulf Coast of Texas.

Canadian officials have criticised their US counterparts for delaying a review into the project, while President Obama has indicated he would not approve the development of the pipeline if it will have severe environmental impacts.

"By co-operating with our North American partners, we are enhancing energy security and the environment while strengthening jobs and the economy," said Greg Rickford, Canada's minister of natural resources, in a statement.

In May, Canadian Environment Minister Leona Aglukkaq said that Canada planned to reduce its greenhouse gas missions by 30 per cent below 2005 levels by 2030 – a target she called fair, ambitious and in line with other major industrialised countries. Aglukkaq added that Canada would take "a responsible and balanced, sector-by-sector approach to reducing emissions, but protect the economy and Canadian jobs."

In the USA President Obama has added new initiatives to his clean energy drive, including the launch of a new Clean Energy Impact Investment Center at the Department of Energy to make information about energy and climate programmes accessible and more understandable to the public and investors. He said in May that the evidence supporting climate change is "indisputable" and that preparing for and adapting to climate change would not be enough.

"The only way the world is going to prevent the worst effects of climate change is to slow down the warming of the planet," said Obama, adding that rising sea levels and an increased risk of natural disasters had the potential to aggravate poverty, political instability and humanitarian crises.

In the US, two senators have sponsored a bill that would require utilities to generate 30 per cent of their electricity from renewable energy sources by 2030.

The bill, proposed by Tom Udall D-N.M., and Edward Markey, D-Mass., went before the Senate Energy and Natural Resources Committee in May. It would create jobs, improve energy security and reduce consumers' energy bills, say its proponents.

Critics say the bill would take decision-making powers on energy away from local and state governments.

Watts Bar 2 nears completion

Nuclear power projects in the USA have made progress with license approvals from the US Nuclear Regulatory Commission (NRC).

Last month the NRC gave DTE Energy approval to construct and operate a new nuclear unit at the Fermi nuclear power plant site in Michigan.

Meanwhile the Tennessee Valley Authority (TVA) said that it was "pleased" that the NRC had agreed to issue a full power operating license for the Watts Bar Unit 2 nuclear power plant, which is nearing completion.

DTE's Fermi 3 unit is the fifth new US reactor to complete NRC's combined license (COL) process. DTE says it has not committed to building the new unit yet, but that it will keep "the option open for long-term planning processes".

The Watts Bar plant near Spring City, Tennessee, is being built under a license initially issued by the NRC in the 1970s. But the operating permit from federal regulators is the first for any new commercial nuclear reactor in the United States since the first unit at the Watts Bar plant was licensed in 1996.

"The commission's action was a critical regulatory step necessary to keep Watts Bar Unit 2 on track to become the nation's first new nuclear generation of the 21st century," TVA's Chief Nuclear Officer Joe Grimes said.

TVA was scheduled to test the equipment in the Unit 2 reactor during hot functional testing during June. It expects to begin power generation at the Watts Bar Unit 2 by the end of this year.

Fermi 3 is a proposed 1600 MW General Electric-Hitachi Economic Simplified Boiling Water Reactor (ESBWR). DTE submitted its COL application in 2008.

Black & Veatch support for DTE included safety analyses, system descriptions and environmental impact studies supporting the application of the COL. Most recently, the company assisted DTE during the NRC license review by providing technical and safety analyses.

Kemper hit by funding setback

Southern Company has been hit with a further setback to its delayed Kemper County integrated gasification combined cycle (IGCC) power plant in Mississippi.

The firm has lost a key backer for the $6.2 billion project and in May notified state regulators that it may have to increase customer rates by up to 41 per cent to pay for the project.

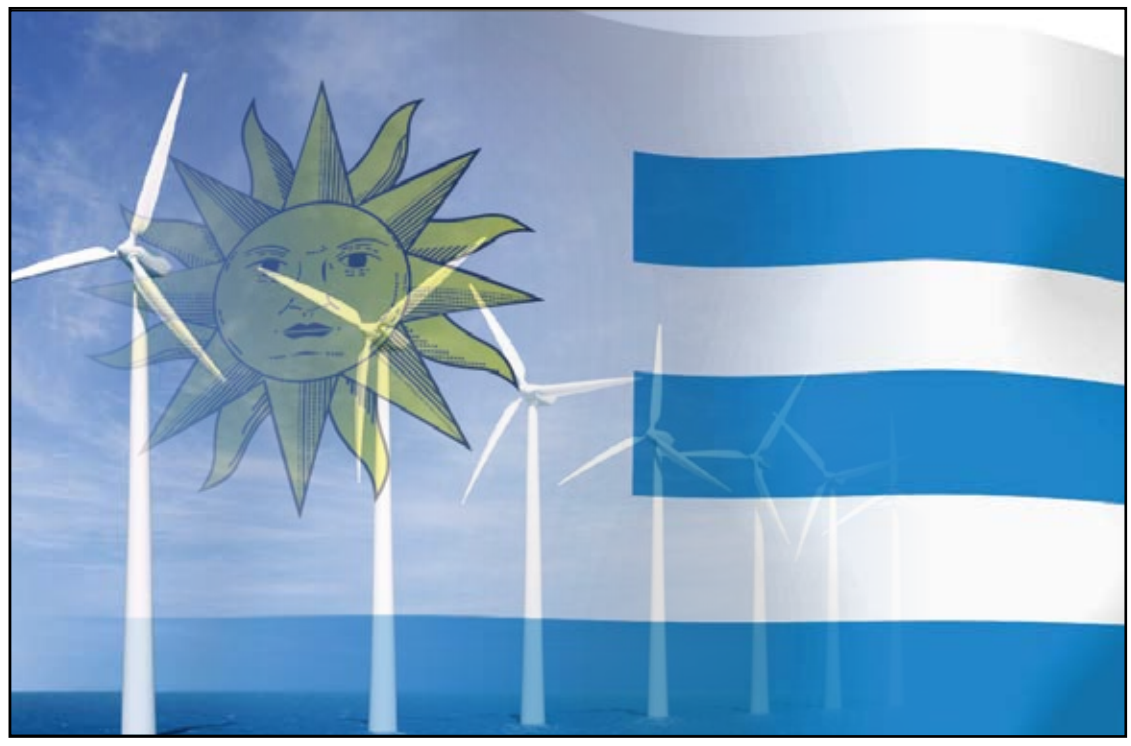
The backer, South Mississippi Electric (SME), had planned to buy a 15 per cent stake in the project for $600 million, but backed out of the deal because of "delays in the project schedule, changing needs and increased participation costs".

The move is a blow to the development of clean coal power generation in the USA following the US government's decision in February 2015 to end its support for the FutureGen 2.0 project in Illinois.

"We entered into the purchase agreement in 2010," said Jim Compton, SME general manager and CEO. "Since then, there have been multiple changes in the project, and also changes in our power supply needs. The board determined that proceeding to closing was not in SME's best interests, and we needed to let [Southern Company] know so that alternate plans could proceed."

The 582 MW power plant has been beset by delays labour disputes and construction problems that have pushed up its price tag. Last year Southern Company put the project's combined cycle unit into operation and said that the plant was on track to start full commercial operation at the end of 2015.

Southern's subsidiary, Mississippi Power, has filed a number of proposals with the state Public Service Commission for recovering costs and says it is committed to minimising the impact of the project on consumer bills.



Financial boost for clean energy in Uruguay

■ Innovative IPO planned
■ IDB backs wind projects

Two wind energy projects have secured financial backing from the Inter-American Development Bank (IDB), giving a boost to the clean energy sector in the South American country.

The IDB has approved two loans worth a total of $216 million for the Colonia Arias and Valentines wind farms. Both 70 MW projects will receive $72 million from the IDB, as well as $36 million from the China Co-financing Fund for Latin America and the Caribbean.

The loan for the construction of the Colonia Arias wind farm will be issued to a trust, the Fideicomiso Financiero Arias, and the loan for the Valentines wind farm will be issued to Areaflin S.A., both created specifically for these projects.

Both projects will offer Uruguayan investors an opportunity to participate in the project financing by issuing an initial public offering (IPO) on the Montevideo stock exchange.

Energy from the wind farms will be sold to Uruguay's Administración de Usinas y Transmisiones Eléctricas (UTE) through long-term power purchase agreements.

Uruguay has set a target to source 90 per cent of its total electricity requirements from clean energy sources by the end of 2015.

In 2014 Uruguay's national energy director said that 84 per cent of the electricity consumed was sourced from renewables.

Lenders shy away from Indian coal fired generation

Although multilateral lending institutions plan to refocus on renewables, Japan will to continue to support coal fired generation.
Syed Ali

Funding from multilateral financial institutions for coal fired power projects in India looks set to fall as the drive for clean generation gains momentum.

The International Finance Corporation (IFC), part of the World Bank Group, says it is refocusing its power sector investment strategy and would soon invest in renewable and hydropower projects in India.

It has made equity and debt investment in wind and solar segments and is now looking at corporate debt finance. IFC has invested $275 million in debt and $47 million in equity in wind and solar energy projects in India.

Gaetan Tiberghien, principal investment officer, infrastructure and natural resources, South Asia, recently told Business Standard: "We do not finance coal projects any more. While natural gas is a difficult sector, solar and wind projects can be deployed rapidly to meet the government's 24x7 power supply plan."

India has ambitious plans for a significant amount of solar, targeting 100 GW by 2022.

What could be a big step in achieving the target was taken in mid-June with the Adani Group signing a joint venture agreement with Rajasthan government to set up a 10 000 MW solar park, which would be the largest facility of its kind in the country.

In a separate move, diversified conglomerate Essel Group recently formed a joint venture (JV) with the Rajasthan government to set up solar parks in the state. Essel Group and Rajasthan government will hold a 50:50 stake in the JV firm – Essel Saurya Urja Company of Rajasthan Limited (ESUCRL) – which will develop solar parks that would produce 5000 MW of clean energy,

In May Essel group also signed a Memorandum of Understanding with Chinese firm, JA Solar, for setting up a solar cell and module manufacturing company in India.

While solar will be an important part of plans to electrify the nation, with the demand for electricity expected to double in the next five years, coal-powered generation will remain the mainstay in its energy mix.

At a time when multilateral funders such as the World Bank have stopped supporting coal-fuelled power projects, Japanese lending institutions and banks are still willing to help India in its quest to provide power to those living without electricity.

Power, coal and renewable energy minister Piyush Goyal held meetings with Japanese institutions in May and said they are keen to finance coal-fired power plants. State-owned NTPC Ltd, has received Yen25.8 billion ($208.3 million) in loans from the Japan Bank for International Cooperation (JBIC) and the Japan International Cooperation Agency (JICA).

"I am in touch with the Japanese. They came and met me and they are very keen to finance coal-based thermal power plants. Rather, most other banks are looking at it as a commercial decision. There may be some agencies who don't want to finance but they are entitled to their own lending decisions. We are looking at innovative financing models with an open mind," said Goyal.

South Korea axes coal plans

South Korea has axed plans to build four coal-fired power plants as it turns to cleaner forms of power generation.

Seoul scrapped a plan to build four coal power plants with a combined 3740 MW capacity, which were not approved due to fuel and transmission facility issues. Instead, it will add a combined 3000 MW through two nuclear power plants, to be built in 2028 and 2029, according to a ministry statement.

The addition will increase the number of reactors to 36 by 2029. Currently, Korea has 23 reactors.

The expansion of nuclear power is included in the seventh 'Basic plan for long-term electricity supply and demand', which covers the period between 2015 and 2029.

Meanwhile, Korea Hydro & Nuclear Power Co. (KHNP) said it accepted the government's recommendation to shut down the Kori-1 reactor, in the southeastern port city of Busan. KHNP has been facing growing public pressure to close the plant following Fukushima. It will be the first time that South Korea permanently closes a nuclear power plant. The original 30-year lifetime of Kori-1, built in 1977, had already been extended once by 10 years.

Commenting on the nuclear plans, a Ministry of Trade, Industry and Energy official said: "Giving up additional coal-powered plants was an unavoidable choice to raise the ratio of environmentally friendly energy sources in the energy mix to meet the growing power demand and in line with Korea's Post 2020 Climate Change Mitigation Commitments.

"We will also raise the ratio of renewables, like solar and wind power, and natural gas in the energy mix…"

The country's wind and solar plans have received a boost in light of several recent announcements.

In June Kumho Petrochemical formed a strategic alliance with wind power company Unison to develop wind projects in the country. Meanwhile, RES signed an agreement with Blue Wind Engineering to expand consultancy services into South Korea, capitalising on the country's ambition to develop its offshore wind industry.

At the end of May, Hanwha Q Cells Korea, the nation's leading solar cell maker, announced plans for a 1.5 GW solar cell production plant in Jincheon County.

Burning out: Korea is turning to more environmentally friendly fuel sources

Japan continues sector shake-up

The Diet has enacted a law that will separate electricity generation from transmission in April 2020, as the final step of a three-stage shake-up of the nation's power sector.

Currently, 10 regional utilities handle all aspects of electricity operations within specified regions, from generation to transmission and distribution.

The government has been pushing total reform of the sector since the 2011 nuclear crisis at Fukushima exposed vulnerabilities in the system, with subsequent shortages and higher electricity prices.

Fukushima also prompted the government to focus on renewables. But although the country has become a leader in solar, it faces the challenge of land availability. This has led to an interest in floating offshore solar power stations.

Two new stations, the largest to-date, started generating in June. The two plants in Kato City will produce 3300 MWh annually. Kyocera, the electronics manufacturer behind the floating solar systems, is also behind another even larger project just east of Tokyo, slated to open next March

Japan is also leading in floating offshore wind. The world's largest 7 MW floating offshore wind turbine is expected to start test operations in September off Fukushima Prefecture.

According to the Economy, Trade and Industry Ministry, only Norway and Portugal have launched floating wind turbines so far, but with much smaller installations.

Meanwhile, the government is still pushing to resume operation of its idled nuclear power plants, which will be key to the country meeting its emission targets.

At the start of June Prime Minister Shinzo Abe committed to reducing greenhouse gas emissions by 26 per cent by 2030 from 2013 levels, as part of efforts to reach a new international agreement on climate change at the end of the year. The goal will be officially submitted to the UN in July.

Bangladesh gets support to ease power shortages

- IFC and WB support gas fired projects
- Indian companies to add 4600 MW

Syed Ali

Bangladesh is taking firm steps to ease severe power shortages.

In June, the Asian Development Bank (ADB) signed finance agreements for a loan of $75 million to private developer Summit Bibiyana II Power Company Limited to help build a 341 MW gas fired power plant.

The news came shortly after the World Bank said it will provide $80 million for construction of the 225 MW Sirajganj combined cycle power plant, for which a contract will be signed soon.

According to recent statistics, Bangladesh has a power production capacity of around 7000 MW but has a daily deficit of about 1500 MW. To address the deficit, the government has a master plan to develop 12 000 MW of new capacity over the next five years, increase its electrification rate and diversify fuel sources to include renewable energy.

Two recently signed agreements will go some way to covering the shortfall. Two of India's leading power companies Reliance Power and Adani Power Limited have signed separate memorandums of understanding (MoU) with the state-run Bangladesh Power Development Board (BPDB) to strategically set up power plants across the country.

Adani Power is planning two coal fired units with a combined capacity of 1600 MW at a cost of more than $1.5 billion. Reliance Power will build 3000 MW of natural gas fired plant with an integrated floating LNG import terminal at a cost of $3 billion.

Bangladesh is set to double the allocation for power projects to be implemented under its Annual Development Programme (ADP) during the next fiscal year (FY), 2015-16.

The government is set to allocate Tk164.85 billion ($2.2 billion) in the ADP for FY 2016 to execute some 66 projects of power sector, against the outgoing FY's allocation of Tk82.84 billion to implement 69 projects.

In May the government formed a four-member panel to find ways to offload the shares of state-owned power companies, to raise capital from the stock market for implementation of future power projects.

- The French donor agency AFD will provide a €100 million loan to the Bangladesh government for upgrading the power supply system of the Dhaka Power Distribution Company (DPDC) Ltd.

UK deals blow to onshore wind

The UK government says there is enough onshore wind capacity planned to meet renewables targets but industry says its plan to end subsidies a year early is flawed.

Siân Crampsie

Senior figures from the European wind industry have rounded on the UK government after it announced it would bring an early end to Renewables Obligation (RO) subsidies for onshore wind energy.

Energy Secretary Amber Rudd said that the government will legislate to close RO subsidies for new onshore wind power projects from April 1, 2016, a year earlier than planned.

After that date, onshore wind developers will have to compete in annual auctions for contracts for difference (CFDs), the UK's new subsidy mechanism for large-scale low-carbon forms of generation.

There was widespread criticism from the renewables industry for the move, which mirrors that taken by the government in 2014 to end RO subsidies early for the large-scale solar sector. Savills Energy warned that the move would destroy investor confidence in the renewables sector and urged the government to "reconsider its decision".

"The government's decision to end prematurely financial support for onshore wind sends a chilling signal not just to the renewable energy industry, but to all investors right across the UK's infrastructure sectors," commented RenewableUK CEO Maria McCaffery. "It means this government is quite prepared to pull the rug from under the feet of investors even when this country desperately needs to clean up the way we generate electricity at the lowest possible cost – which is onshore wind."

McCaffery added: "If government was really serious about ending subsidies it should be working with industry to help us bring costs down, not slamming the door on the lowest cost option."

Juliet Davenport, CEO of Good Energy, said that the government "should be providing solid, stable support for renewable energy". She added: "Onshore wind developers… have invested millions of pounds in good faith based on the government's original timetable. This decision will bring further instability and uncertainty to investors and is transactional government at its worst."

Davenport's comments were echoed by Michael Watson, Head of Projects at legal firm Pinsent Masons. "It… sends out a damaging signal to investors at a time when the UK is desperately seeking investment into energy infrastructure," said Watson. "On the back of EMR and changes to solar policy, what this highlights is a continued disconnect between the long-term commitments expected by investors and short-term political thinking."

Rudd said that there would be a 'grace period' enabling onshore wind projects that already had planning consent, a grid connection offer and evidence of land rights to benefit from RO subsidies. She also confirmed that the Department of Energy and Climate Change (DECC) would look at options to continue support for community energy projects, as part of the Feed-in Tariff Review later this year. This follows measures announced in the Queen's speech to change the law to give local communities the final say on onshore wind applications.

Rudd said that although onshore wind was an important part of the UK's energy mix, the country had enough subsidised projects in the pipeline to meet renewable energy commitments. In an official statement to parliament, she added that there would be roughly 12.3 GW of onshore wind delivered in the UK by 2020.

"It is therefore appropriate to curtail further deployment of onshore wind, balancing the interests of onshore wind developers with those of the wider public," said Rudd.

Ben Warren, Energy Corporate Finance Leader at EY, disputed the government's policy stance. "The rationale behind the announcement is that the UK has enough onshore wind capacity to help it meet its targets," said Warren. "This ignores both the fact that onshore wind can, and already does, provide cost effective power, as well as the economic, social and environmental benefits that stem from it."

DECC estimates that around 5.2 GW of onshore wind will qualify for the grace period.

Swansea Bay costs in the spotlight

- 'Super-quarry' proposals opposed
- Helm: end CFDs

A decision to grant planning permission to a landmark tidal energy project in the UK has been welcomed by the renewables industry but criticised because of its potential cost.

Energy Secretary Amber Rudd gave the go-ahead to the Swansea Bay tidal lagoon project in June. The project will involve construction of a 10 km-long horseshoe-shaped sea wall around Swansea Bay in Wales and installation of a 320 MW tidal power plant.

Renewable energy organisations including Regen SW, RenewableUK and Ocean Energy Europe welcomed the planning consent, hailing it as a major step forward in the development of a tidal energy industry. Six potential lagoon locations have been identified around the UK and combined, they could provide up to eight per cent of the UK's electricity needs.

"Tidal power is an essential second generation renewable technology, necessary to decarbonise our energy mix, create a new industrial sector and balance the grid," said Rémi Gruet, CEO of Ocean Energy Europe. "Europe has been watching with great excitement the developments at Swansea Bay and the potential follow-up projects. Once the concept has been proven at Swansea, a pipeline of projects will provide significant amounts of jobs and growth in the UK and in other areas of Europe."

However the project's £1 billion price tag and potential environmental impacts are causing concern. In an analysis of UK energy policy, Professor Dieter Helm, an economist specialising in utilities, infrastructure, regulation and the environment at the University of Oxford, suggests that the UK government should avoid supporting expensive projects such as tidal lagoons, and instead focus on other energy efficiency projects.

"Picking new 'winners' can be avoided. This might start with the lagoon – which looks like being so expensive as to make even offshore wind look cheap – and move on to stopping even more offshore wind farms being built.

"Rudd could get on with the cheaper stuff quickly – closing the coal, and keeping the gas-fired power stations in business for the next decade," Helm writes in his paper, 'British energy policy – what happens next?'

Helm also suggests that the UK's new contracts for difference (CFDs) are unnecessarily complex and could be replaced by fixed price contracts that would enable renewable energy technologies to compete with each other.

The tidal project in Swansea is also causing controversy because of plans to mine stone for the project in Cornwall, southwest England, and ship it through a marine conservation zone to Swansea Bay.

Battery technologies show their mettle

A smart grid demonstration project in France is aiming to show how innovative energy storage solutions can help to ensure economically and technically efficient integration of renewable energy sources into rural medium voltage distribution networks.

ERDF, Saft and Schneider Electric have inaugurated the largest ever battery energy storage system in France and say that the technology will not only support wind power generation but also demonstrate a new business model for energy storage systems.

The Venteea project is set to run for three and a half years

The Venteea project is set to run for three and a half years and comprises a Saft Intensium Max 2 MW/1.3 MWh battery system and Schneider Electric's Energy Storage Box. Other partners in the project include GE, EDF, Boralex and RTE et Made.

Venteea applies intelligent technologies that operate on two levels. Firstly, it optimises two-way communication with the grid and helps meet all technical requirements.

Secondly, it enables next-day forecasting of electricity production and demand, in turn allowing for the development of more tailored services that meet both grid and customer requirements.

This 'multi-service' approach paves the way for a new business model in which storage costs are spread across the different stakeholders involved.

According to EY, investors find it difficult to get a clear view of the opportunities, business models and most suitable markets for energy storage.

In its latest review of renewable energy markets, it said that the market must highlight the various entry points for investors and focus on creating an investable asset class for storage products that delivers the necessary returns.

Ben Warren, EY's Global Power & Utilities Corporate Finance Leader said: "With a number of storage technologies already proven and costs falling fast, we must stop thinking about storage as something that will arrive tomorrow. It arrived yesterday and the game is already changing.

"It's time to start viewing storage as just another energy asset that generates long-term predictable revenues and needs competitive and appropriate construction capital solutions."

The Venteea project is located in Champagne-Ardenne, the main region in France for wind generation. The industrial-scale demonstrator network includes a primary substation with a 20 MVA transformer, six 20 kV feeders and 130 secondary substations supplying 3200 customers.

Two wind farms are connected to the network, with an installed capacity of 12 MW (dedicated feeder) and 6 MW (non-dedicated feeder).

Separately, Alstom and Saft have commissioned a smart battery energy storage system (BESS) at EDF's Concept Grid Lab in France's Seine-et-Marne region.

The 1 MW per 30 minute BESS consists of an Intensium Max 20 lithium-ion battery and an Alstom real-time energy storage management software system. It will demonstrate the use of batteries in grid frequency regulation applications.

THE ENERGY INDUSTRY TIMES
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Morocco pledges emission cuts

Morocco has set a target to cut its greenhouse gas emissions in a bid to show its commitment to reaching a global deal on climate change later this year.

The government says that it will aim to cut emissions by at least 13 per cent by 2030 and estimates that the policy will cost $10 billion. Environment Minister Hakima el Haite said that the country could commit to an "additional reduction of 19 per cent", at an estimated cost of $35 billion.

Morocco is due to host the 22nd Conference of the Parties (COP22) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016. Some 200 nations met in June in Bonn, Germany, to agree the foundation of a global deal it is hoped will be reached at COP21 in Paris in December.

■ Sener has secured a contract to develop 510 MW of thermosolar capacity in Morocco. Under the €500 million contract, Sener, along with its partner Shandong Electric Power Construction III (SEPCO III), will undertake engineering, construction, commissioning and start-up work for the 200 MW Noor II and 150 MW Noor III facilities near Ouarzazate.

Environment Minister Hakima el Haite says $35 billion needed for deeper emission cuts

Molefe: "We plan to continue with our maintenance programme in an effort to reduce the backlog."

South Africa eases power shortages

South African utility Eskom has boosted its available generating capacity to help ease shortages, but challenges still remain ahead.

Siân Crampsie

Eskom says that the return to service of unit 1 at the Koeberg nuclear power station has helped to stabilise the power system ahead of the start of the cold peak periods this winter.

The South African utility has continued to implement load shedding arrangements throughout June but says that 900 MW from Koeberg and the end of an industrial dispute at the Medupi coal-fired power plant had helped to bolster available generating capacity.

Acting Chief Executive, Brian Molefe, said that the company now planned to continue reducing the maintenance backlog while minimising load shedding events.

"The focus of our maintenance drive is to ensure long-term reliability and sustainability of our power generating plants," said Molefe. "Since December last year, the availability of Eskom's plant performance has improved from 65 per cent to 75 per cent. Going forward, we plan to continue with our maintenance programme in an effort to reduce the backlog that has accumulated over the past few years."

Koeberg unit 1 had been offline for a planned three-month maintenance and refuelling programme. Eskom confirmed in June that the Medupi power plant was producing 800 MW for the first time.

The power plant's unit six – the first to be brought on line – is still undergoing final testing before being handed over to Eskom. It was first synchronised to the grid in March 2015 but work was disrupted in April by a labour dispute that saw around 1000 workers fired.

Eskom also announced last month that it had successfully commissioned the 100 MW Sere wind power project in Western Cape province, while Nordex said that it had added 80 MW to the grid with the start up of the Kouga wind farm in Eastern Cape.

The Sere project is one of the largest wind farms in South Africa and supported by the African Development Bank and Clean Technology Fund.

President Jacob Zuma said in May that load shedding could continue in South Africa for another two to three years because economic growth and electrification projects were boosting electricity demand.

In addition, Public Enterprises Minister Lynne Brown said that Eskom does not have enough coal in stock to meet its generation needs beyond 2016.

According to *Reuters*, the 17 million tonne coal shortfall will become obvious this year at Matla, Tutuka and Hendrina power stations, while Kriel and Arnot power stations will began suffering in 2016.

South Africa depends on coal to generate 85 per cent of its electricity. Falling coal prices have also caused coal mining firms Glencore and Anglo American to scale back output.

The last of Medupi's 800 MW power units is due start operating in 2019, while the Ingula pumped storage hydropower project will add 3000 MW to the grid in 2016.

Eskom is also developing a 100 MW concentrating solar plant (CSP) project near Upington in the Northern Cape.

More investment needed for sustainable energy goals

Annual global investments in clean energy need to triple to $1.2 billion by 2030 to end energy poverty around the world, according to a new report.

The report, produced by the World Bank and 20 other organisations and agencies tracks progress on the Sustainable Energy for All (SE4ALL) initiative, and says that more finance is required in renewable energy and energy efficiency.

The SE4ALL programme targets universal access to modern energy services, doubling the rate of improvement in energy efficiency, and doubling the share of renewables in the global energy mix by 2030. The report says that 1.1 billion people in the world still live without electricity and almost 3 billion still cook using polluting fuels like kerosene, wood, charcoal and dung.

And, while picking up steam, renewable energy generation and energy efficiency improvements will need to accelerate dramatically, it says.

"We are heading in the right direction to end energy poverty," said Anita Marangoly George, Senior Director of the World Bank's Energy and Extractives Global Practice. "But we are still far from the finish line. Leveraging public finance to mobilise private capital is imperative in achieving these goals."

According to the report, annual global investments in energy will need to scale up from roughly $400 billion to meet the three targets. Of the $1.2 billion required, between $40 billion and $100 billion annually is needed to achieve universal access to electricity.

By contrast, universal access to modern cooking fuels to replace wood, charcoal and dung which cause serious pollution and respiratory problems requires just $4.3 billion a year.

The World Bank reported in May that the carbon pricing market reached a worth of $50 billion in 2015, while Moody's Investors Service said that the global green bonds market reached $37 billion in 2014, and could nearly triple to $100 billion in 2015.

The data suggests that investment in clean energy is growing, supported by emissions trading schemes, carbon tax mechanisms and the green bonds market.

Citing estimates from the Climate Bonds Initiative, Moody's reported that the global green bonds market could hit $100 billion this year with China's plans to open its debt capital markets and reduce pollution.

Oman adds to power supplies

Companies are vying to participate in key projects designed to boost Oman's growing electricity sector.

Eleven companies are reported to be in the race for a project management and consultancy services contract for the Musandam independent power project.

The Musandam Power Company, a joint venture between the Oman Oil Company and LG International, has already signed Wärtsilä to carry out the engineering, procurement and construction of the power plant, and is now seeking a consultant to oversee construction, commissioning and testing of the 120 MW project.

Tractebel Engineering, Atlas International Engineering Consultants, Jacobs CES, and AF Consult LTS are thought to have expressed interest in the project. Électricité de France, Engineering Innovation Design and Consulting, Moneco Consulting Engineers and Mott Macdonald have also expressed interest.

Elsewhere in Oman, the Oman Environmental Services Holding Company – also known as Be'ah – says a detailed feasibility study of its landmark waste-to-energy initiative is due to be completed by the third quarter of this year, while the Oman Power & Water Procurement Co. (OWP) has signed a series of agreements with Mitsui & Co. for developing new capacity.

A provisional study of Be'ah's proposed venture, part of a wider strategy by the state-run utility to restructure and privatise the Sultanate's solid waste sector, has been determined as "very promising", according to a high-ranking executive of Be'ah.

In May, OWP signed agreements with Japan's Mitsui for the construction of the 445 MW Salalah Phase 2 independent power project and the acquisition of an existing 273 MW power plant from Dhofar Generating Company.

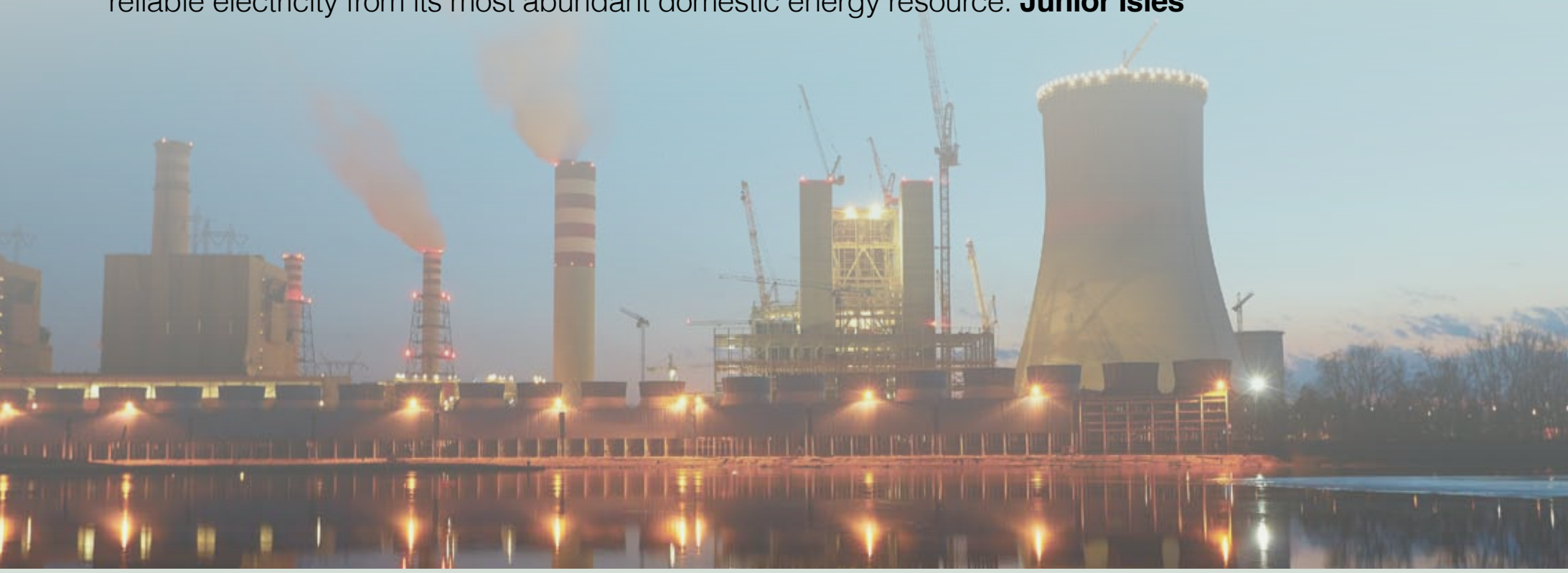
Power generation from the new plant is expected to commence in the first quarter of 2018.

"This new capacity will contribute to the growing power demand to meet the needs of urban, industrial and tourism development in the governorate of Dhofar as well as enhancing the efficiency of gas consumption," said Eng. Ahmed bin Saleh Al Jahdhami, chief executive officer of OPWP.

Special Project Supplement

Poland banks on high efficiency coal generation

Construction is well under way on what is being hailed as one of Europe's most efficient coal fired power plants. When it begins operation, the Kozienice 11 power plant in Poland will boast an electrical efficiency of more than 45 per cent, helping the country to fulfil its ambition of generating affordable, reliable electricity from its most abundant domestic energy resource. **Junior Isles**



About 60-70 km southeast of Warsaw on the banks of the Wistula River, the erection of the steel structure takes shape for a coal fired plant that will be of great significance to Poland.

Kozienice 11, located in Swierze Górne near Kozienice, is being built by Mitsubishi Hitachi Power Systems Europe (MHPSE) with its Polish consortium partner Polimex-Mostostal S.A. When it is complete in just over two years from now, the new plant will be the most efficient coal fired plant in Poland, rubber-stamping the country's determination to continue to use domestic coal to provide affordable, reliable electricity while keeping emissions well within EU environmental limits.

Poland's rationale for continued coal use is understandable. The country has the largest reserves of coal in the EU and uses the fuel for about 90 per cent of its electricity. In 2013, Poland produced 164 billion kWh gross from 34 GWe of mostly coal capacity. Coal provided 140 TWh of electricity, gas 5.1 TWh, biofuels 8.7 TWh (mostly co-fired in coal plants) and wind 6.0 TWh.

With an economy that is growing by around 3 per cent a year, Poland is in need of new capacity and the strategy is to power that growth with coal.

During a visit to the plant site in April, outgoing President Bronislaw Komorowski said the new power unit will strengthen Poland's coal-based electricity production, which is in line with the policy of "focusing on one's own resources", promoted by Poland in the EU. According to Komorowski this strategy significantly raises Poland's energy security, which he says "is always a part of the national and economic security".

Rainer Kiechl, CEO of the MHPSE Board of Directors commented: "With the construction of Kozienice 11, Mitsubishi Hitachi Power Systems Europe takes on an important task in the extension of the Polish power generation system and in ensuring a dependable supply of electricity in an expanding economy. These economically emerging countries are placing their trust in assured, low-cost and technically highly developed power production from national energy sources involving a high local value added."

> "These economically emerging countries are placing their trust in assured, low-cost and technically highly developed power production from national energy sources…"

With a design net electrical efficiency of 45.59 per cent, the Kozienice 11 unit will be the most efficient coal fired plant in Poland and among the top five in Europe.

Wolfgang Schreier, Chief Operating Officer, MHPSE, noted: "It's the first in Poland to have an efficiency of nearly 46 per cent and follows a generation of coal fired plant like those we have seen in Germany and the Netherlands."

The new plant will have a net generating capacity of 1000 MW and will be hooked into both the 110 kV and 220 kV grids, and controlled remotely from a control centre in Warsaw some 70-80 km away.

"Schreier commented: "Not every country can take a 1000 MW unit but the grid is stable enough to take such a large unit."

Kozienice 11 is being built on an existing site, where there are currently 10 units with a generating capacity of 2905 MW. It is an important facility – it is the second largest in the country, after Belchatow, and represents 8 per cent of the country's installed capacity.

The new unit provides a boost to the local economy. While MHPSE is responsible for delivering all the major equipment, the entire balance-of-plant, HV electricals, civil works and construction is being handled by Polimex-Mostostal. At a total cost of zlotys6.3 billion (€1.5 billion), Kozienice 11 is the biggest energy investment in Poland. About half of the contract value is being handled by the domestic consortium partner.

Indeed there is a requirement that local partners must be involved in such projects. While some companies may view this as a constraint, MHPSE says the proviso has its advantages.

"It is a smart way to do it because there are things, such as Polish civil law for construction, that are typically better handled by local companies," said Schreier. "Also because the contract is paid in Polish zlotys, it's quite advantageous to have a lot of the supply in zlotys. It means we don't have to hedge for conversion to euros."

The most important components for the ultra-modern unit either come from companies within the corporate group or from parent company Mitsubishi Hitachi Power Systems, Ltd. (MHPS). These include the utility boiler, coal bunkers, coal mills, firing equipment, flue gas cleaning, and some balance-of-plant. MHPS is supplying the steam turbine, generator, auxiliary equipment and the flue gas desulphurisation (FGD) plant.

It is not the first work that MHPS has carried out at the site. MHPS has performed all the FGD retrofits on the existing units.

The existing site was an obvious choice for the new highly efficient Unit 11. In addition to the infrastructure, the site is next to the Wistula River, which provides the cooling water to feed the huge cooling tower.

The plant will receive bituminous coal by rail from all over the country. Although the plant is designed to burn Polish coal, it can in fact run on coal from elsewhere if necessary.

Coal arriving at the plant will typically be high volatile bituminous coal with a calorific value of 20 000-24 000 kJ/kg, ash content of 16-25 per cent, sulphur content of 0.8-1.3 per cent.

Coal is fed by conveyor belt to the plant where it is first crushed to a fine powder by a series of mills before being fed into the boiler at a rate of 101.9 kg/s (guarantee coal).

Four mills are located at the bottom of the boiler, which MHPSE says is quite unusual for a boiler of this size.

"There are typically 6-8 mills for a boiler this size but we have used four large mills," noted Schreier.

The boiler, which has a gross maximum power output of 1075 MW, measures 104 m at its highest point. Unlike a two-pass boiler, which is more common in places like the UK or US, Kozienice 11 will use a tower-type boiler where the convective heat section is above the radiant section of the boiler. The convective heating surface is above of the evaporator.

The boiler features 32 wall-fired, internally-staged low NO_x burners – eight burners situated on four levels inside the boiler.

Supercritical steam conditions within the boiler are the biggest contributor to the plant's high efficiency. The once-through Benson design steam generator produces 2894 t/h steam with a superheated steam reheat temperature of 603°C at 250 bar and reheat steam at 621°C/55 bar.

"The 603°C/250 bar is quite something and is typical for this new generation of high efficiency boilers. It's pretty unique for Europe. In this part of the world the temperatures are similar but the pressures are usually 20-30 bar higher," noted Schreier.

Supercritical steam conditions represent a physical point just above the triple point of water. When the boiler pressure reaches above the critical pressure of 221.2 bar and temperature of 374°C, two-phase mixtures of water and steam cease to exist, and are replaced by a single supercritical fluid. These steam conditions allow a once-through boiler design where the high steam temperature and pressure results in greatly increased efficiency compared to a drum-type boiler.

Supercritical steam is fed to an advanced four-casing steam turbine of dual shell design. There is a high-pressure (HP) turbine, a double-flow intermediate-pressure (IP) turbine and two double-flow low-pressure (LP) turbines. The LP end of the turbine is connected to a hydrogen-cooled generator.

Steam at the turbine inlet is 242 bar with main steam temperature of 600°C and reheat temperature of 620°C.

The steam turbine is state-of-the-art, featuring advanced seal technology for improved tip seal performance and higher reliability.

An advanced 3-D blading profile design is utilised for high steam turbine efficiency. Advanced seal technology is used to reduce losses. The steam turbine and generator are manufactured in Japan. Notably, only ferritic steel made in Japan is used, as opposed austenitic steel. MHPSE says this has some key advantages.

Jürgen Klebes, Head of the thermal design department, explained: "If you combine a ferritic steel rotor with austenitic steel blades there can be problems in the long term, caused by the different rates of thermal expansion. We can handle the 600 degrees temperature with just ferritic steel. Japanese manufacturers have the longest experience with this steel," explained Klebes.

The development of high-temperature resistant steels in Japan is the essential key for building this new generation of highly efficient ultra-supercritical power plants. The economy of ultra-supercritical (USC) power plants depends on reliable evidence of their long-term strength. Japan has a great deal of experience in operating USC steam power plants, with references that demonstrate high reliability since 1998 with live steam temperatures of 600°C and reheat temperatures of 610°C to 620°C.

The low-pressure section is where the steam turbine has its greatest innovation.

"What is very special," says Klebes, "is that for the first time in Europe, we see the use of a 60-inch last stage blade in the low-pressure turbine. The largest is currently 49 inches." With this new last-stage blade, the cooling water temperature of 17°C and the vacuum of 40 mbar can be utilised in the steam turbine at quite moderate steam turbine exhaust velocities, which results in accordingly higher plant efficiency.

The large cooling tower also helps to maximise efficiency at the site. Because the plant is located next to a river in the middle of the country, the cooling water conditions are not as favourable as if the plant was located next to the sea with direct seawater cooling. Consequently, not only is the cooling water warmer than if it came directly from the sea but also there is a constraint on the amount of available cooling water. Schreier joked: "In Poland a river can be frozen in winter but dry in the summer."

At 185 m-high, the cooling tower is one of the tallest in Europe. Explaining its significance, Schreier said: "Height relates directly to the efficiency of the plant." The cooling is a closed circuit where the water in the cooling tower can reach 33°C. The cooling water from the tower is used to cool the condensate in the condensers.

Schreier added: "The river water is essentially used to top-up the evaporative water losses that occur during operation. This means no water is returned to the river. This is not like some plants in Germany where river water goes into the plant and slightly warmer water is returned to the river. But as units get bigger, warmer water is returned to the river, which is not good for the marine life."

The plant's design not only limits the effect on the local marine environment but also uses best available technology to limit impacts on air quality.

Kozienice 11 has a sophisticated environmental protection system so that emissions are either equal to or lower than EU environmental limits. There are three systems: a selective catalytic converter (SCR) to reduce NO_x emissions from the combustion process; a electrostatic precipitator (ESP) to capture dust; and an FGD system to capture SO_x.

The SCR, located behind the boiler, receives gas directly after the convective heating surfaces at a temperature of about 350-360°C. Ammonia is injected into the SCR reactor, where it reacts with the NO_x to form water and nitrogen.

Flue gases leaving the SCR flow through an air heater before entering the ESP to capture dust.

Desulphurisation is achieved through the use of the limestone gypsum process, where gypsum can be recovered as the end product for further industrial use. This process involves sulphur dioxide (SO_2), hydrogen chloride (HCl) and hydrogen fluoride (HF) being precipitated in an alkaline scrubbing liquid.

The flue gas enters the lower part of the MHPS absorber and ascends through the absorption section. Intelligent technology ensures that the number of nozzle levels of the contact zone and positioning of the nozzles are designed to the desired absorber collecting efficiency. Up-to-the-minute computations of flue gas entry angle and speed make it possible for turbulence to be kept well down inside the absorber. A large and a fine droplet separator retains the fine droplets in the flue gas before the cleaned gas leaves the absorber. The actual transition from pollutant gas to liquid occurs in an intensively intermixed gas/liquid contact zone.

The limestone-induced absorption gives rise to a high-grade gypsum product.

Flue gases leaving the plant do not go through the stack but instead are vented into the cooling tower. The dust emitted at the end is a combination of what is caught by the FGD and the ESP, but at the cooling tower is 10 mg/Nm³. This is much lower than the 20 mg/Nm³ specified EU standard.

NO_x will be 100 mg/Nm³ compared to the EU limit of 200 mg/Nm³. SO_2 emissions will also be limited to 100 mg/Nm³, which is half the EU limit.

These levels are significantly better than the other 10 units at the site. "They are roughly half of the existing plant but are pretty much in line with the coal plants that are now going into operation in Germany or

"With the construction of Kozienice 11, MHPSE takes on an important task in the extension of the Polish power generation system," says MHPSE CEO Rainer Kiechl

Kozienice 11 is being built on an existing site, where there are currently 10 units with a generating capacity of 2905 MW

MHPSE is responsible for delivering all the major equipment, while the entire balance-of-plant, HV electricals, civil works and construction is being handled by Polimex-Mostostal

the Netherlands," said Schreier.

The project has been long in the making but building work is now well under way at the site.

Elektrownia opened discussions on the project some time in 2010 but it was some time before the contract was awarded.

Schreier explained: "Poland follows a very strict and formal procedure. You have to follow the specification. No deviation is allowed, unlike in some countries where you can work with the customer to bring other ideas to optimise the unit."

Following the contract award on September 21, 2012, site access was granted on October 2nd. Demolition of some existing facilities began immediately, with preparation of underground networks, etc., and the official ground-breaking took place on November 26, 2012.

To meet the scheduled construction dates a significant amount of assembly work has to be done on the ground at the site, and the assembled components then lifted into place. However, although this speeds-up construction, the lifting of heavy components to high points using cranes can only be done when it is not too windy.

"If it's windy at heights of 150 m, there can be delays and we have experienced more than the normal amount of windy days," said Schreier. But overall the project team has been fortunate with the weather and the boiler steel structure was finalised in June last year.

Although the wind may have caused problems, the last two winters have not been severe and so construction has been progressing well.

"Much of the required pre-manufactured material has had to come from various parts of Poland, which is a bit of a logistical challenge but it has been arriving on time and fits. So construction has been proceeding even a little bit faster than at the beginning," added Schreier.

The next challenge is to close the building before the coming winter, so that the electrical installations can be started.

All the boiler parts have been more or less fabricated and are being pre-assembled at site before placement in the boiler house. Boiler erection is ongoing together with work on items such as the pressure parts, ductwork and piping within the vicinity of the boiler. Coal handling equipment within the boiler vicinity has also been erected, i.e. coal bunkers that sit on top of the mills. The mills themselves are in the final stage of fabrication. Rotary air heaters have been installed.

MHPSE is also now at the beginning of ESP erection – the steel structure to support the ESP is being installed. Meanwhile, erection of the FGD is also ongoing with the absorber already completed.

First deliveries of components for the steam turbine and generator have been made, i.e. the condenser and some vessels such as the heat exchanger. The turbine and generator will arrive on site in the coming months. They will be transported by ship from Japan and then transferred to site by rail.

"Bearing in mind a generator can weigh up to nearly 500 t, rail is the best mode of transport for heavy equipment in Poland," said Wilhelm Dickel, Project Director, MHPSE for Kozienice 11. "We have already prepared the necessary railway connections so they can be brought directly to the turbine hall."

As of mid-June, the plant was around 35 per cent complete. According to the schedule, the boiler pressure test is expected on February 2016. First fire is slated for August 2016 and commercial operation date is planned for July 2017.

It will be an important landmark for Poland. Poland's government sees the plant as integral to the country's future prosperity. In addition to providing local jobs, it will support Poland's mining industry. Most importantly it will provide low-cost, reliable, electricity to drive economic development.

Schreier commented: "Being such a large plant, I am sure it will provide the lowest cost of electricity in the entire fleet. But it is not just about cheap electricity. The plant surpasses all of the current environments standards."

For MHPSE, Kozienice 11 is hugely important – not only is it a sizeable contract in terms of value but it also provides a significant workload for four to five years. MHPSE notes, however, that the project represents only an initial step for the company in Poland. Construction of a second power plant – a 500 MW lignite power station in Turów – started in May this year. MHPSE says such projects demonstrate its intention to play a significant role in the expansion of the power generation system in Poland, Eastern Europe and Turkey.

Most importantly, however, MHPSE says it demonstrates its ability to win orders against increasingly stiff Chinese competition.

Schreier concluded: "What has made us very proud is that we were able to beat the Chinese in this open competition. This proves that when you look at the total evaluation – not only the price but the combination of execution time, efficiency and price – it shows we have a fair chance of winning contracts, even against China. And when it comes to meeting environmental targets we have proved that countries in Europe have a significant advantage."

CAD drawing showing the new unit and cutaway of the boiler house and turbine hall

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EDF bid too low, says Areva


Varin told Parliament the offer needs to be improved

Prospects of an agreement between Areva and EDF over a bid for Areva's nuclear unit within a month seem unlikely.

Siân Crampsie

EDF may have to improve its offer for Areva's nuclear reactor group if it is to reach a deal with its French associate.

The utility's bid for a majority stake in Areva's nuclear unit has been approved by the French government but Areva chairman Philippe Varin told parliament last month that the offer needs to be improved.

He also said that EDF would have to share some of the risk in the problematic Olkiluouto 3 EPR reactor project in Finland in order for a deal between the two firms to be agreed. He also confirmed that a foreign investor could take a minority share in its nuclear unit as part of the plan engineered by the state to dig Areva out of financial trouble.

Media reports indicate that EDF's bid for Areva's nuclear unit is around the €2 billion mark, below the €2.7 billion valuation in Areva's accounts. "We need an equitable negotiation with EDF about the valuation of Areva's reactor unit," Varin told the French Parliament. "EDF has made a proposal, this proposal must be reviewed," he added.

Areva's nuclear unit accounts for around 40 per cent of Areva's revenues but has been hit by competition from rival manufacturers as well as a fall in demand for nuclear reactors in the wake of the Fukushima disaster.

The French government said in June that it wants the firms to reach a deal within a month. The state's rescue plan includes a capital injection of what will remain of Areva. Varin said that a minority investment by Chinese firms, or by another energy utility, in the nuclear unit had not been ruled out.

He also indicated that arbitrators in a legal case between Areva and its Finnish customer in the Olkiluouto project could soon make a preliminary ruling on certain aspects of their dispute.

Areva and its partner in Olkiluouto, Siemens, have been blamed by Finnish utility TVO for delays and cost overruns at the EPR project. Varin described the project as a "sword of Damocles that has weighed" on Areva for a long time and that EDF would have to share in the risk.

Sgurr signs up Chilean partners

SgurrEnergy is expanding its presence in the Chilean renewable energy market through a collaboration with two local energy consultancy and management firms.

The Scotland-based company has formed strategic partnerships with Coener and Mankuk to provide services to the Chilean renewable energy market, which is expanding rapidly due to high energy demand growth and the need to diversify energy sources.

The three companies will combine their renewables expertise and local knowledge to strengthen their services and market offerings. "SgurrEnergy's worldwide expertise combined with the in-country contacts and knowledge of our Chilean partners will be a strong combination to further develop the renewables industry in the country," said SgurrEnergy's international office manager, Molly Iliffe.

Coener is a renewable energy consultancy, with over 15 years' experience in providing engineering solutions to clients on projects in Chile. Mankuk is a consulting and management company focused on providing engineering, legal and environmental solutions to Chilean energy projects.

SgurrEnergy has already completed projects in Chile, including performing the role of lender's engineer for an onshore wind farm in which the scope included an independent energy yield forecast, review of financial models, site visits and contract reviews.

Santander launches renewables investment firm

- Cubico launched with $2 billion portfolio
- Targets long term investments in global markets

Siân Crampsie

Banking giant Santander says that its new renewable energy investment firm has "significant capital to invest" and is "committed to a long term growth strategy".

Santander has joined forces with two of Canada's largest pension funds, Ontario Teachers' Pension Plan and the Public Sector Investment Board (PSP Investments) to launch Cubico Sustainable Investments.

Based in London, Cubico will manage funds and invest in renewable energy and water infrastructure assets globally. Santander, Teachers and PSP Investments, all equal partners in the new company, are aiming to make Cubico one of the largest and best in class renewable energy and water investors in the world.

Santander has transferred 19 wind, solar and water infrastructure assets to Cubico, giving it a balanced and diversified portfolio valued at $2 billion. The assets in operation, construction or under development have a total capacity of more than 1400 MW and are located across seven countries: Brazil, Mexico, Uruguay, Italy, Portugal, Spain, and the United Kingdom.

Santander says that Cubico has a mandate to hold assets for the long term and will focus on identifying assets that will achieve significant scale and value. Local Cubico specialists will play a role in the management of each asset.

"Today represents the beginning of an exciting new chapter for us," said Marcos Sebares, Chief Executive Officer, Cubico Sustainable Investments. "Renewable and water infrastructure developments require decisive long-term investment and commitment. We are uniquely positioned to provide this through our strong ownership structure, experienced team and global footprint.

"We have already built a strong pipeline of attractive assets to add to the platform and look forward to working with our partners over the coming years to consolidate Cubico's position as one of the world's leading renewable energy and water infrastructure investors."

Gamesa targets growth

- New platforms planned for launch
- Expansion key to growth plans

Gamesa is aiming to achieve double-digit growth over the next three years by diversifying its geographical presence.

The wind turbine company says that it will aim to increase sales to 3500-3800 MW by 2017 as well as double its operating profit.

The company says that it will maintain its leading position in key wind energy markets such as India, Mexico and Brazil as well as in China, where it is the largest foreign manufacturer in terms of market share.

It is also aiming to increase its presence in mature markets such as the US and Europe, and expand into Asia-Pacific and Africa.

The goals were outlined in Gamesa's Outlook 2015-2017, in which the firm said it planned to lock in the profitable growth achieved in the 2013-2015 plan.

The company has also set out targets for cost control and a sound balance sheet and said that it would maintain an attractive dividend policy and accelerate shareholder value creation.

Sales in 2015 will be close to 3100 MW, said Gamesa, which is also planning to launch a new 3.3 MW platform to help it strengthen its position in key markets such as Europe, Mexico, Canada and Australia. It will also extend its 2.5 MW platform into India and Brazil, it said.

In the area of operation and maintenance, the company expects 20 per cent growth in revenues through 2017, boosted by growth in MW under maintenance, new long-term contracts and an offer of value-added products.

Beyond 2017, Gamesa is planning to expand in the offshore wind sector as well as other sectors such as solar energy.

Adwen, Gamesa's joint venture with Areva for the offshore wind energy business, is working on the development of 8 MW wind turbines to strengthen its position in the European market, in which it aspires to a 20 per cent share by 2020.

Gamesa is exploring opportunities in sectors that offer a high level of synergy with the wind business, such as solar and off-grid, particularly in India.

Conergy, Sungrow collaborate

Renewable energy firm Conergy has signed up Sungrow as a key supplier to help it expand its business.

The two companies have announced a strategic partnership in which Conergy will purchase inverters from Sungrow for many of its commercial and utility-scale projects over the next year.

Conergy, one of the world's largest downstream solar companies, selected Sungrow after a "rigorous" evaluation process and will use Sungrow's inverters for the first time under this partnership in a 5 MW photovoltaic (PV) project in the UK.

Conergy has a global 3.4 GW project pipeline and said that Sungrow met its criteria to support its "global growth in all major PV market segments".

Americas

Alstom wins Chile contract

Transmisión Eléctrica del Norte (TEN) has selected Alstom to supply four turnkey substations for the Mejillones-Cardones transmission line, the first interconnection between Chile's two transmission grids.

The €260 million contract includes the installation of three new 500 kV substations and the expansion of a fourth. The project is due to be completed in 2017 and will enable surplus energy from the northern grid (SING) to be transferred to the central grid (SIC) and vice versa.

Alstom will provide air- and gas-insulated substations as well as its high voltage power compensation products.

Aleva selects Parker Hannifin

Alevo Group has selected Parker Hannifin to supply systems for the transfer of energy from battery-based energy storage systems to the utility grid in North America.

The contract follows an agreement between Alevo and Customized Energy Solutions (CES) signed earlier this year to provide 200 MW of energy storage to the US wholesale market using Alevo's GridBank battery modules.

The deal represents the largest ever deployment of energy storage in the USA. Parker's Global Energy Grid Tie division will initially supply power conversion systems, battery container control and thermal management systems to meet the energy storage needs of several key independent systems operators in the United States and Canada.

The energy storage systems will enable the operators to substantially reduce emissions and increase efficiencies in their electricity distribution networks.

Asia-Pacific

L&T wins NTPC contract

Larsen & Toubro (L&T) has won an engineering, procurement and construction (EPC) contract from NTPC Limited for the construction of a greenfield ultra-supercritical thermal power plant in the Khargone district of Madhya Pradesh, India.

The project, worth Rs5580 crore ($1.03 billion), envisages the construction of two 660 MW coal-fired thermal units. L&T's scope includes design, engineering, manufacture, supply, erection and commissioning of the two units.

This project is the first order received by L&T from NTPC for a complete thermal power plant.

Emerson to automate new NTPC plant

NTPC Limited has placed an order with Emerson Process Management to provide automation technologies and expertise for two new 800 MW supercritical generating units at the Darlipali super thermal power station in Sundergarh District, Odisha, India.

Emerson project teams will engineer, install and commission Ovation systems to monitor and control each unit's supercritical boiler and critical balance-of-plant processes and equipment. Emerson will also provide its Rosemount Analytical online steam water analysis system and continuous emissions monitoring system, Rosemount pressure and level transmitters, and additional instrumentation.

The new units will help meet the energy needs of the region's growing population. Unit 1 commissioning is expected in December 2017, with Unit 2 to follow three months later.

Kosep orders Doosan fuel cells

Doosan Fuel Cell has been selected by Korea South East Power Co. Ltd. (Kosep) to provide 13 PureCell Model 400 fuel cell units to the utility's plant in Bundang, a Seoul suburb.

The new installation will incorporate a state-of-the-art construction design – the first of its kind in South Korea – with multiple 400 kW fuel cells installed on each floor of a two-story structure. The installation will conserve valuable urban land resources, taking up half the space of previous configurations, while maximising power density.

The 13-unit installation will produce 5.6 MW of clean energy and heat for the local electric grid and Kosep customers and is fully scalable to support the addition of power plants to meet future needs.

The new project comes only one month after six Doosan fuel cells went live at the Kosep facility in Ansan, also near Seoul, South Korea's capital.

Europe

ETI seeks CCS co-venturers

The UK's Energy Technologies Institute (ETI) is seeking co-venturers to develop an investable concept for major new power generation capacity fitted with carbon capture and storage (CCS).

The organisation says it will invest up to £2 million in the project, which will identify the technical and commercial foundations and create the business case for a specific Phase 2 CCS project. The project will take advantage of new CCS infrastructure being built and bring momentum to the next phase of CCS development in the UK.

The project would be supported by a contract for difference (CFD), the UK's low-carbon support mechanism.

The request for proposals will close on 14 September 2015. The deadline for notification of intention to submit a proposal is 14 August 2015.

Contracts awards for Rampion

E.On has awarded major contracts for equipment and services for the Rampion offshore wind farm in the UK.

JDR will supply subsea cabling technology and services while ABB will provide substations and related power infrastructure.

JDR will design and manufacture 142 km of 36 kV inter-array cables for the project. The scope of work also includes the supply of hang-offs, electrical t-connectors, inner cone connectors, cable cleats and a J-tubeless cable protection system specifically designed to optimise installation time and minimise the potential for cable damage during installation and operation.

ABB will provide power infrastructure for the offshore platform as well as the onshore substation to efficiently integrate the new wind farm into the country's transmission grid. It will also extend an existing substation that will receive the wind power.

Meanwhile Babcock won the contract to deliver the engineering, procurement and construction (EPC) of the 2500 tonne offshore substation platform (OSP) topside and jacket for the project.

Rampion is the first offshore wind farm off the south coast of England, comprising 116 of Vestas' V112-3.45 MW offshore wind turbines providing a total capacity of 400 MW. It is due for completion in 2018.

Contractors chosen for NEMO link

NEMO LINK has announced the two winning contractors that will build the first electricity interconnector between Great Britain and Belgium. They are Siemens and J-Power Systems, a subsidiary of Sumitomo Electric Industries, Ltd.

The contracts are together valued at about €500 million. Siemens will build the converter stations in both Kent and Zeebrugge using their HVDC Plus technology and will have a five-year service and maintenance agreement.

J-Power systems will design, manufacture and install the state of the art HVDC XLPE cable system – the first time it will be used operationally as a high voltage direct current link at 400 kV

NEMO LINK is the joint venture between National Grid and Elia, the Belgium Transmission System Operator, to deliver the 1000 MW subsea link between the two countries.

Europe opts for 8 MW wind turbine

European Energy A/S has placed an order with MHI Vestas for two V164-8.0 MW and two V117-3.45 MW turbines for an onshore project in Esbjerg, southern Denmark.

The 23 MW order for the Måde project in the port of Esbjerg will enable further testing of the installation and operation of the world's most powerful offshore wind turbine. It will also enable MHI Vestas to make improvements to its V117-3.45 MW turbine platform.

The project includes a 20-year full scope service agreement, with delivery of the turbines expected to take place in the fourth quarter of 2015.

The first V164-8.0 MW prototype was installed at the Danish National test centre in Østerild in early 2014 and has been selected by Dong Energy for the 258 MW Burbo Bank Extension project in the UK.

MHI Vestas Offshore Wind has also entered into a conditional agreement with Dong Energy regarding phase 1 of the Walney Extension Offshore Wind Farm. MHI Vestas was named as preferred supplier earlier this year. MHI Vestas is to supply V164-8.0 MW wind turbines for the 330 MW project.

Siemens has been selected as a preferred supplier for delivery of its 7 MW wind turbine for phase 2.

Fortum selects Brady trading platform

Fortum has chosen Brady plc to implement an energy data management (EDM) solution ahead of the Nordic Balancing Settlement deadline.

The EDM is a front-to-back physical trading platform with a fully integrated communications gateway and is purpose-built to process and store the high levels of data generated in deregulated energy markets.

Chinese firm selected for UK tidal project

Tidal Lagoon Swansea Bay plc (TLSB) has named China Harbour Engineering Company Ltd (CHEC) as the preferred bidder for a £300 million contract for the proposed Swansea Bay tidal power project.

The £1 billion project will harness the huge tides from the Severn Estuary that separates England from Wales. TLSB has selected CHEC as preferred bidder for the marine works and the two companies have also signed a bilateral agreement to develop tidal lagoon power projects in Asia.

International

Nordex strengthens position in Turkey

Nordex is to install 19 of its N117/2400 wind turbines at the Kertkayasi wind farm in Turkey.

The project will be the second implemented by Nordex in the Central Anatolia region this year and will strengthen the firm's market share in the country.

The Kurtkayasi project is being developed by ARE Elektric near the city of Yayhali in the province of Kayseri. The wind conditions at the site are expected to enable a capacity factor of more than 37 per cent.

Substation supports solar expansion

The Dubai Electricity and Water Authority (DEWA) has placed an order with ABB for the expansion of a substation that will integrate a large-scale solar farm with the grid.

Under the $20 million contract, ABB will design, engineer, supply, install and commission the project using three bays of 400 kV and 11 bays of compact 132 kV gas-insulated switchgear (GIS), power transformers, and an automation and control system.

The expansion project will enable DEWA to double the net output capacity of phase II of the Mohammed bin Rashid Al Maktoum solar park from 100 MW to 200 MW. ABB previously won a substation order in 2014 to integrate 100 MW from the park into the grid.

The project is due for completion in 2016.

Chinese consortium signs Angola deal

A Chinese consortium has won a contract worth $4.5 billion to build a hydropower plant in Luanda, Angola.

China Gezhouba Group Corporation (CGGC), Boreal Investment Limited and CGGC & NIARA Holding will construct the 2171 MW project. CGGC has a 60 per cent share in the consortium, while Boreal is the second largest stakeholder. The project will take six years to build.

Mainstream awarded wind contracts

A consortium led by Mainstream Renewable Power has been awarded preferred bidder status by the Department of Energy on South Africa for two large-scale wind energy projects with a total generating capacity of 250 MW.

The award was made under the fourth round of the South African government's Renewable Energy Procurement Programme and the two wind farms represent an investment of about $469 million.

The two projects are the 140 MW Kangas wind farm in Northern Cape and the 110 MW Perdekraal East wind farm in Western Cape.

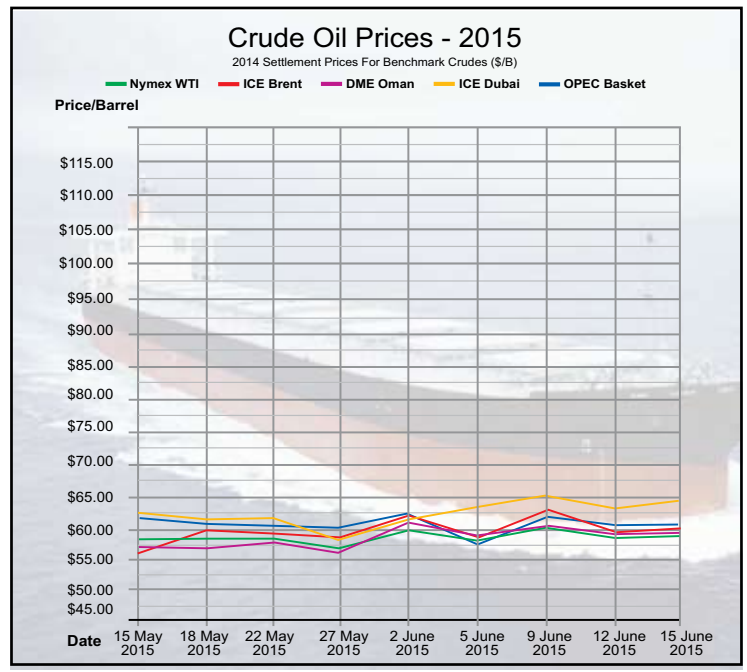
In addition to these two projects, Mainstream is currently constructing three wind farms in Northern Cape totalling 360 MW, which it was awarded under Round 3 of the programme.

Oil

A leaner, meaner Opec keeps pumping for market share

- Gross export revenues fall below $1 trillion
- US output increased during 2014

David Gregory



Like many of us, Opec is seeing leaner financial times. But when it comes to the market, the barrels are bulging as the group's biggest producer, Saudi Arabia, stays determined to out-pump everyone else.

According to the organisation's latest *Annual Statistical Bulletin*, released on June 24, the 12 members of Opec saw a decline in the total value of crude oil exports during 2014.

Last year Opec earned a total of $964.6 billion from crude exports, the first time that group gross export revenues fell below $1 trillion since 2010, when they hit $794.2 billion.

Export revenues in 2013 totalled $1.104 trillion, down from $1.204 trillion in 2012. Earnings in 2011 amounted to $1.104 trillion.

Saudi Arabia, which remains determined to break the back of the North American shale oil revolution by keeping production at 10 million bpd or better, saw its export revenues decline during 2014 to $285 billion, down from $314.0 billion in 2013 and down from $329.3 billion in 2012.

Saudi Arabia's determination to maintain the Opec production quota at 30 million bpd has driven crude oil prices down from around $115/b a year ago to currently average around $65/b. Riyadh's stance has hit hard several Opec members, such as Iran, Venezuela and Nigeria, whose budgets depend on $100/b-plus oil.

The Opec data showed that Libya suffered the worst drop in revenue during 2014, but that was due primarily to the disruption in oil production and export caused by factional fighting. Export income for 2014 totalled $14.8 billion, compared to $44.4 billion in 2013, $60.1 billion in 2012, $18.6 billion in 2011 and $47 billion in 2010.

Sanction-hit Iran's export earnings amounted to $53.6 billion in 2014, down from $61.9 billion in 2013 and $101.4 billion in 2012. Iran's 2014 earnings are less than half of its 2011 export revenues of $114.7 billion.

During 2014, Saudi Arabia produced an average of 9.713 million b/d of crude, its highest daily annual average since 1980 when the country produced an average of 9.9 million b/d. Iran produced an average of 3.117 million b/d, followed closely by Iraq with output averaging 3.110 million b/d.

The *Annual Statistical Bulletin* said Opec's total cumulative production of crude oil stood at 492 868 162 barrels. By comparison, US crude oil production has gone from 5.481 million barrels in 2010 to 8.663 million b/d in 2014. US output increased during 2014 by 16.1 per cent over the 2013 average of 7.461 million b/d, according to the Opec data.

The Asia and Pacific region is Opec's primary market. Total exports to the region average 13.667 million b/d out of a total average of 22.644 million b/d exported. Angola, Iran, Iraq, Kuwait, Qatar, Saudi Arabia and the UAE ship the bulk of their crude exports to the Far East.

Saudi Arabia exported an average of 7.153 million b/d during 2014 and of that 4.417 million b/d was delivered to the Asia and Pacific region. Saudi Arabia's total exports averaged 7.571 million b/d in 2013, with 4.586 million b/d shipped to the Asia-Pacific region.

The price of the Opec reference basket averaged $96.29/b during 2014, compared to $105.87/b in 2013 and $109.45/b in 2012.

According to Opec, world crude oil production averaged 73.4 million b/d in 2014 and Opec production averaged 30.7 million b/d. World oil demand averaged 91.3 million b/d, the bulletin reported.

World proven crude oil reserves stood at 1492.9 billion barrels at the end of 2014, and proven crude oil reserves among Opec countries remained unchanged from 2013 at 1206 billion barrels.

Saudi Arabia is expected to continue raising production during 2015. Output is forecast to rise to as much as 11 million b/d by some analysts, who say the move is a show of Saudi determination to guard the country's share of the market.

Opec members endorsed again at the group's ministerial meeting in early June Saudi Arabia's policy to maintain a production target of 30 million b/d.

That position, and the fact that the market is over-supplied by about 2 million b/d, has forced US shale oil producers to cut back on output. But as US shale oil is now seen as the new swing crude, output of which will move back and forth with the fundamentals of the market, US shale oil production can be expected to come back into production as soon as it becomes profitable to pump.

While some analysts forecast that oil price will increase as the market adjusts to the new dynamics, others say prices are likely to remain in flux around $60/b for several years.

Gas

Iran's gas industry plans for sanction-free times

Iran is confident it will resume gas exports when there is an agreement on lifting sanctions. But if outstanding issues are not addressed, there will not be a deal.

Mark Goetz

Iran has made it clear in recent months that it is keen to return to the international energy market. Since it reached a framework agreement over the future of its nuclear research programme with the P5+1 group in Lausanne, Switzerland, in early April, Iranian officials have exuded confidence that international sanctions that have restricted foreign investment, money transfers and oil sales for several years will be lifted once a final agreement is hammered out. The deadline for that was June 30.

Iranian President Hassan Rouhani and most recently Iran's Supreme Leader Ayatollah Ali Khamenei have stated that sanctions must be lifted once the deal is done, but that is not the understanding that US and European negotiators in the P5+1 group have. According to statements by US President Barack Obama and Secretary of State John Kerry, if an agreement is reached, sanctions would be lifted gradually over several years as Iran complied with terms of the final accord.

Responding to remarks made by Khamenei in late June about sanctions having to be lifted before an agreement is signed, Kerry said the Ayatollah's comments were meant for Iran's domestic consumption.

"It may be that the Iranians will not fill out the full measures of what was agreed on in Lausanne, in which case there will not be an agreement," Kerry said on June 26 prior to leaving for the last round of negotiations in Vienna. He added that if outstanding issues with the Iranians are not addressed, there will not be a deal.

Iran's immediate goal is to get its oil back on the market. Only a few countries are allowed to purchase Iranian crude. Some media reports have suggested that Iran has some 30 million barrels of oil stored in tankers and is keen to deliver the cargoes.

It was recently disclosed that a number of foreign energy companies that were doing business with Iran before sanctions were imposed, namely Shell, Total and Eni, have met with Iranian officials to discuss their return to Iran's hydrocarbon industry, which will need significant foreign investment if it is to get near the potential that its huge reserves would allow.

Prior to sanctions, there were at least three LNG projects under way in Iran that were eventually abandoned by their foreign partners as sanctions took effect. In a recent statement to Iranian media, Alireza Kameli, head of the National Iranian Gas Exports Company (NIGEC), said the company would like to revive those projects in the near future and export the LNG to Europe.

Iran ranks with Russia and Qatar with the highest natural gas resources in the world, estimated at 33.8 trillion cubic metres (or about 1200 trillion cubic feet), plenty to support the 40 million tons/year LNG capacity that it is keen to develop.

Kameli said Iran is planning to "swiftly begin studies and execution of this project" once sanctions are lifted and reach that LNG export capacity within three years.

Iran also wants to export more gas by pipeline but pipeline projects to Oman, Pakistan and the UAE have not materialised and are unlikely to as long as sanctions are in place.

Building pipeline networks in other countries is also an option. Deputy Petroleum Minister Hamid-Reza Araqi said the National Iranian Gas Company (NIGC) "is capable of designing and building gas distribution networks in other countries and supplying all necessary equipment."

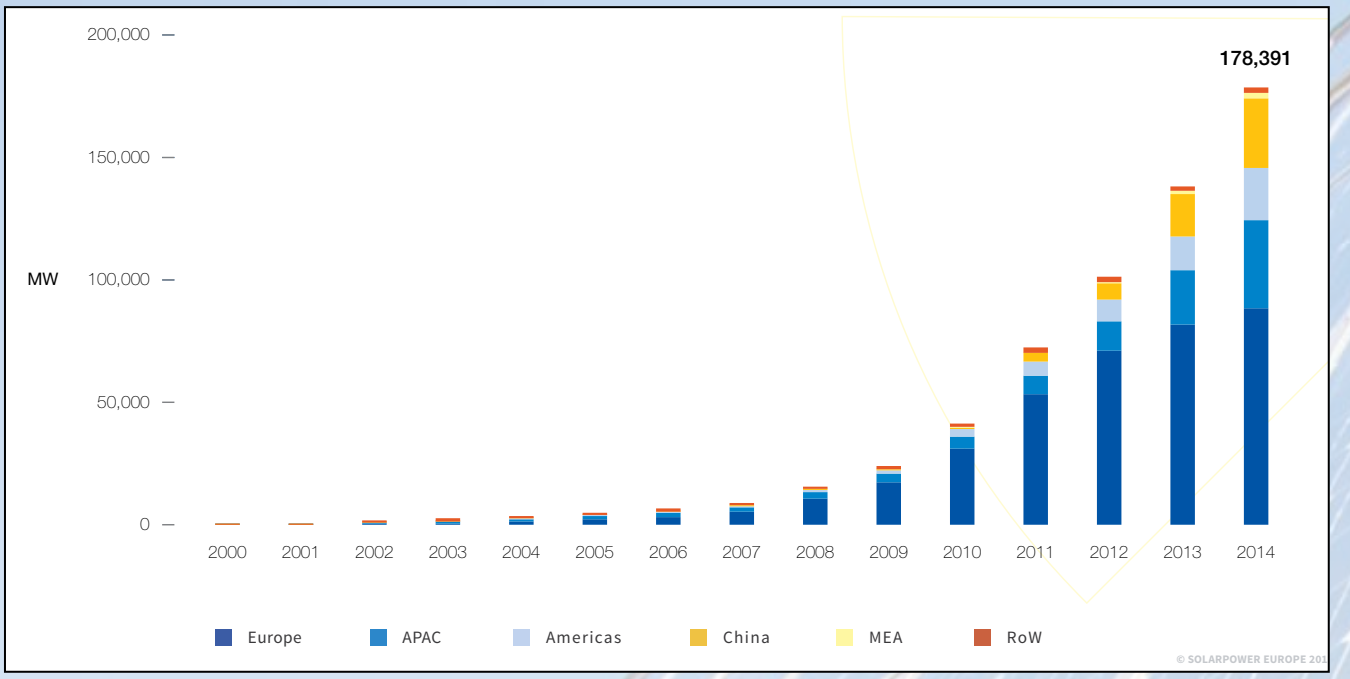
There's no doubt that Iran has the gas resource available to be a gas powerhouse but becoming sanction-free is one of the conditions that will have to exist if it is to develop its natural gas resources, which for now fall short of domestic demand on occasion.

The country's politics have made it difficult to deal with, and improved terms are going to have to be offered to foreign investors when they do return. The country will need lots of money and technology in order to get serious development under way.

Whether Iran will be able to export huge volumes of gas is questionable. There is growing domestic demand for power generation and the oil industry itself uses large volumes of gas to reinject into oil wells to maintain reservoir pressure.

The ability to bring Iran's gas potential to significant use will first of all depend on the outcome of the negotiations over the nuclear research issue. If there is a deal, then while sanctions will likely not be lifted suddenly, plans for the future can at least begin. If there is no deal, then there is no deal.

Evolution of global solar cumulative capacity 2000-2014



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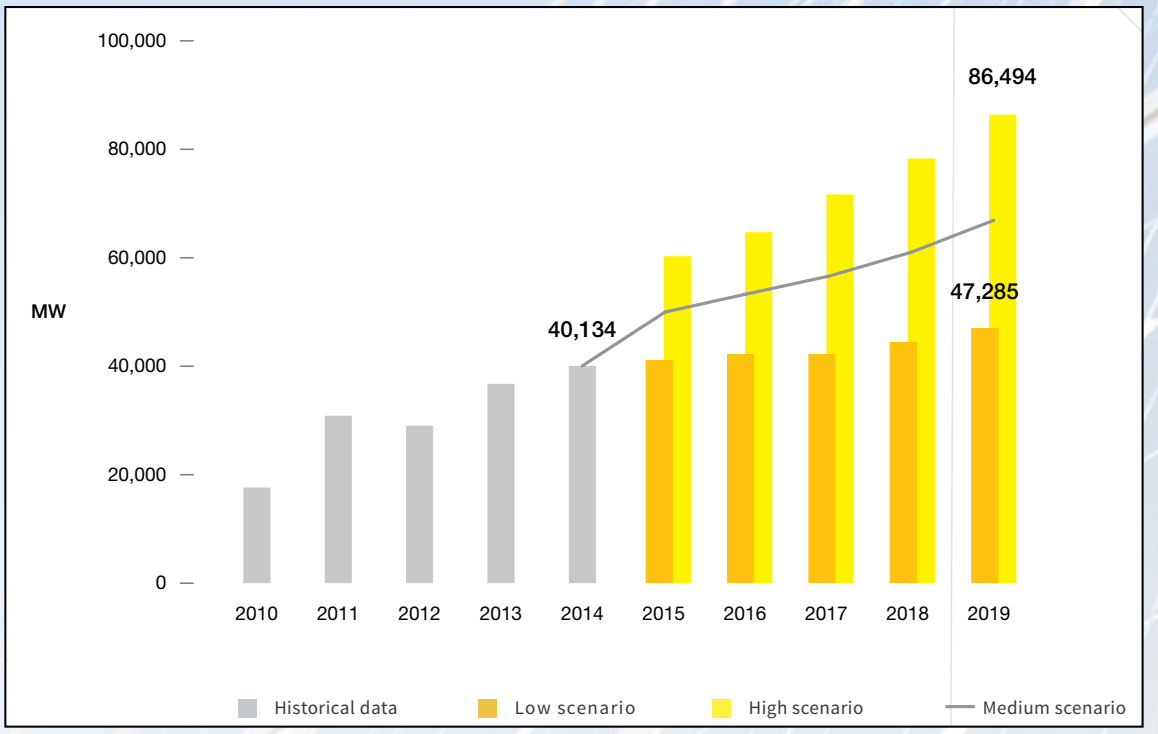
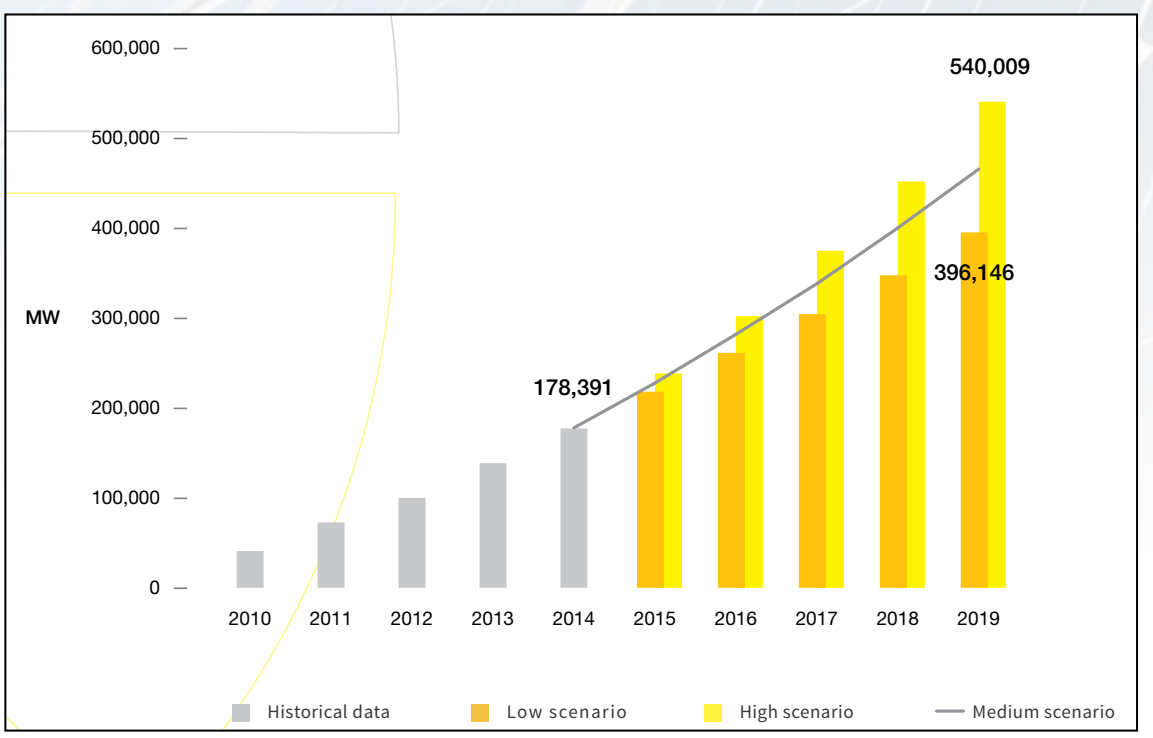
Global solar PV annual market scenarios until 2019



Global solar PV cumulative market scenarios until 2019



Source: Global Market Outlook for Solar Power 2015-2019. © SolarPower Europe

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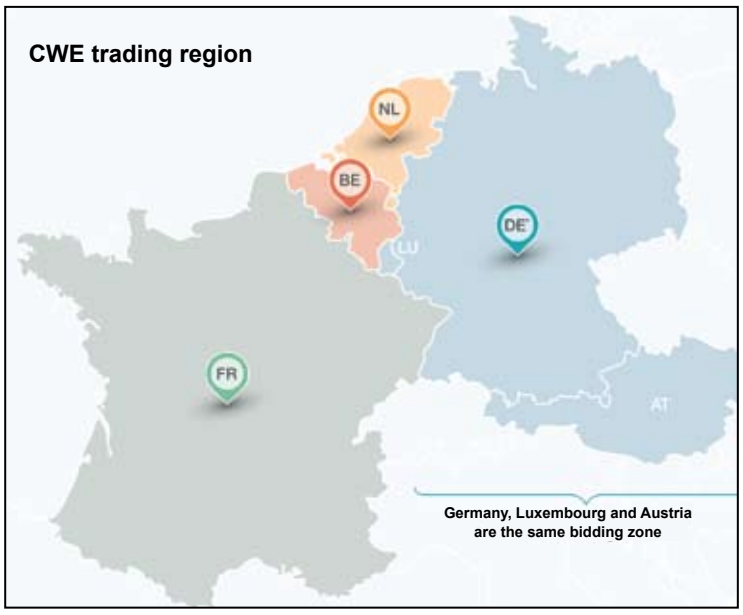
Sophisticated couples

Europe is moving towards a more sophisticated method of calculating available transmission capacity. ***TEI Times*** looks at the new Flow-Based Market Coupling methodology, which is aimed at improving security of supply and is likely to bring greater convergence of power prices across Europe.

The number of high voltage transmission interconnectors in Europe has been increasingly steadily as the bloc strives towards an internal energy market. Indeed the issue of interconnectors was a key part of proposals for European Commission proposals for an Energy Union unveiled in February this year. The proposals include a target for 10 per cent interconnection of electricity grids across borders by 2030.



Interconnectivity is vital for EU Energy Union, which aims to create a bloc where surplus energy can be moved across borders to make up shortages. But the need for greater interconnectivity goes beyond increased security. EU members stress that increasing Europe-wide interconnection would greatly benefit European consumers.

In the UK, analysis by UK grid operator National Grid has estimated that each 1 GW of new interconnector capacity could reduce Britain's wholesale power prices by up to 1-2 per cent. In total, 4-5 GW of new links built to mainland Europe could unlock up to £1 billion ($1.5 billion) worth of benefits to energy consumers per year, equating to nearly £3 million per day by 2020.

Yet although new interconnectors are being built, the method of calculating the amount of capacity that is actually available for transmission across borders at any given time has been questionable. Further, a better method was essential in order to be prepared for accurate and secure capacity calculation in a European energy sector where further growth in renewables is expected.

In late May, the project partners of the Flow-Based (FB) Market Coupling in Central Western Europe (CWE) (Amprion, APX, Belpex, Creos, Elia, EPEX SPOT, RTE, TenneT and Transnet BW) announced the successful launch of the FB market coupling methodology.

The new method is designed to lead to a more efficient determination of commercial transactions and of resulting physical flows, helping market participants to trade across borders. The end result is allocation of capacity where it is most needed and with the fewest possible grid constraints.

By providing a better representation of the actual grid situation and relevant information for proper price formation, CWE FB market coupling is expected to ultimately drive investment decisions.

CWE Transmission System Operators (TSOs) and Power Exchanges have been working on FB market coupling since June 2007 when the MoU of the Pentalateral Energy Forum on market coupling and security of supply in CWE was signed. Market coupling in CWE then started in November 2010 by using ATC (Available Transmission Capacity)-based grid capacity calculation.

The development broadly consisted of the following stages: conceptual design; prototyping of tools; industrialisation of prototype tool into stable production systems; parallel run process to let external stakeholders experience and understand the difference in price formation between ATC market coupling and CWE FB market coupling; integration and simulation testing.

The ATC-based method relies on the available transmission capacities, which were defined by the TSOs for each border of the CWE zone. Since then, developing and implementing the FB method has required harmonisation of TSOs' processes, organisation and systems.

Project partners started detailed preparation by performing a parallel run process: FB parameters and implied market results were calculated in parallel with the operational daily ATC process. Since 2013 the simulations have been shared with the market and National Regulators (NRAs), first on a weekly and then on a daily basis, to provide optimal support in the transition.

The FB method was finally approved by NRAs on April 23, 2015 and was successfully run for the first time in the CWE day-ahead market coupling process on 20 May (for delivery day 21 May). The CWE TSOs had jointly started the operational coordination process and the calculation of flow-based parameters the day before.

While facilitating cross-border electricity exchanges and integrating renewable energy into power supply, the FB methodology is a big advance towards the integration of Europe's energy markets.

At the time of the launch Wim Michiels, Jean Verseille, and Andrew Claxton, TSOs' & Power Exchanges' chairmen of the CWE Flow-Based steering groups said: "We are proud to be now live and using the new method, which enables the further integration of the European market against a background of the increased challenges we face due to more volatile system conditions. This is an outstanding example of how Power Exchanges and TSOs contribute to a more competitive and reliable internal European energy market."

The launch does not only mark a crucial milestone for European market integration and paves the way towards the completion of the European Internal Energy Market. Due to its dynamic nature, its developers say it also allows for optimising the capacity available for trading which in turn will translate into significant economic welfare gains.

Market coupling optimises the efficiency of power trading by allocating cross-border transmission capacity between the different coupled spot markets, while ensuring that the physical limits of the grid are respected. In so doing, it is expected to narrow price spreads between national power markets and increases social welfare for the involved countries.

Highlights of the impacts of market coupling on price were reported in a market review released by Dutch electricity transmission operator TenneT at the start of May. In the publication TenneT reviews and analyses relevant market developments, including price developments in the European wholesale electricity market in 2014. The market analysis focuses on the Netherlands and its neighbouring countries: Germany, Belgium and France.

According to the TenneT Market Review, market prices in the Netherlands and Germany are gradually converging. Whereas prices were equal in both countries for 19 per cent of the time in 2013, this figure rose to nearly 30 per cent in 2014.

The price decrease in the Dutch market in 2014 is attributable to various causes, said the report. Average gas prices were lower than in the previous year, three new coal-fired power plants were taken into operation, a number of gas-fired plants were taken out of operation, and cheaper electricity was imported from Norway and Germany on a large scale. This was possible thanks to the land-based and subsea interconnectors that link the Netherlands to its neighbouring countries.

The subsea NorNed cable linking the Netherlands and Norway is used almost exclusively to import cheaper electricity from Norway to the Netherlands, while the three interconnectors between the Netherlands and Germany are largely used for transmitting electricity from Germany to the Netherlands. Meanwhile the subsea BritNed cable exports electricity from the Netherlands to the United Kingdom most of the time.

Germany has also benefitted from the interconnectors as solar energy can be exported to generate more income. Furthermore, this results in a reduction in the lower renewable energy surcharge payable by German consumers. In this way interconnectors contribute to the optimum deployment of renewable energy sources in Europe.

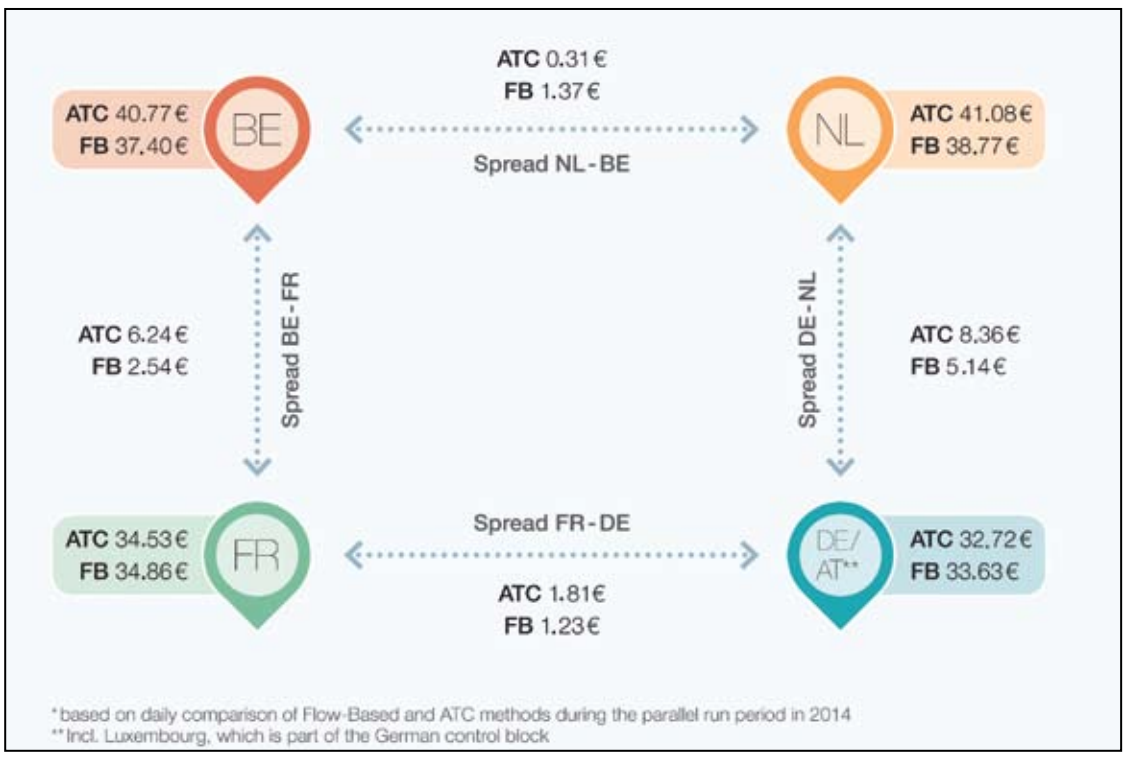
According to TenneT, Dutch electricity consumers benefit to the tune of €80 million per year as a result of cross-border trade.

FB market coupling is expected to result in further reduction of price differences between the Netherlands and Germany.

Following its success in day-ahead market coupling in the CWE region, the FB method is expected to be deployed both at a larger European scale and also in different time windows for electricity trading (e.g. intra-day application).

By generating a more accurate picture of a more complex reality, FB market coupling looks set to provide energy players, policymakers and authorities with a better basis for decision-making on investments in generating facilities and network infrastructure.

Electricity prices: Simulations in 2014* compared the previous ATC-method and the new Flow-Based method electricity prices (€/MWh) in and the spread between countries. On average, a decrease in prices and spread has been observed



Time to turn up the heat on bioenergy use

Bioenergy has a key role to play if Europe is to cut greenhouse gas emissions in the power sector and reduce its dependency on gas imports, especially for heat.

Heinz Kopetz

Two issues – a reliable climate mitigation policy and the security of energy supply – have reached new levels of urgency during the last year. The latest reports from the International Panel on Climate Change (IPCC) make it clear that only a strong reduction in the use of fossil fuels will permit the world to comply with the 2°C target in this century. Meanwhile, ongoing tensions in the Ukraine demonstrate the vulnerability of an energy system that is strongly dependant on gas imports from Russia.

An accelerated deployment of renewable energy sources (RES) in combination with an ambitious energy efficiency policy would be the best strategy to mitigate both problems. In such a strategy, biomass – as the biggest renewable energy source – will have to play an important role.

Overview electricity generation, TWh, 2012, EU 28

Energy carrier	TWh
Coal	902
Nuclear	882
Renewables	799
Natural gas	615
Others	97
Total	3925

Contribution of renewable energy to final energyconsumption (Mtoe), EU 27

	2007	2012	2030
Biomass	77	102	226
Other RES [1)]	41	62	273
Total RES	118	164	499
Total Final energy in EU27	1195	1104,5	1124
Share of RES (%)	9.9	14.8	44.4

Source: EREC, 'Re-thinking 2050'. Brussels 2010.

1) Other RES: hydro, wind, PV, geothermal, solar thermal, concentrated solar power, ocean, etc.

Contribution of biomass to final energy Mtoe

	2007	2012	2030 EREC
Electricity	8.8 (102 TWh)	12.8 (149 TWh)	21.5 (250 TWh)
Heat	61.0	74.7	165.0
Biofuels	8.0	14.6	40.0
Total	77.8	102.1	226.5

Scenario for the supply of biomass in 2030, Mtoe EU 28

	2010	2030
Wood	79	101
Biogas	11	23
Biofuels	13	30
By-products agriculture: straw, corncobs, landscape cleaning	10	20
Cellulosic energy crops, others		43
European biomass for energy	113	217
Imports	5	23
Primary energy from biomass including imports	118	240

Today's energy system is based predominantly on fossil fuels. By 2012 in Europe 76 per cent of the primary energy consumption was covered by fossil fuels, the rest by nuclear energy and renewables (11 per cent).

According to the IEA's 'Energy and Climate Change June 2015' report, in 2014 CO_2 emissions from fossil fuels reached a volume of 32.2 Gt. In 2011 the IPCC working paper said that 90 per cent of the global CO_2 emissions were caused by the use of fossil fuels, with CO_2 accounting for 75 per cent of all greenhouse gas emissions.

The burning of biomass also releases CO_2 but this CO_2 does not come from the earth's crust. Plant matter absorbs CO_2 from the atmosphere via photosynthesis and the carbon in plants is released to the atmosphere in any case – either by natural decay or by using and finally burning the biomass. Hence biomass is carbon neutral whereas the burning of fossil fuels creates a huge carbon debt for future generations.

Climate science has been studying the carbon issue for years. In the last report IPPC presented the carbon budget approach. It states that if mankind wants to keep the temperature rise in this century below 2°C, the total quantity of CO_2 emissions must not exceed a given limit in this century. Broken down, this limit is estimated at 1.6 tons of CO_2 per capita, for each year from now to 2100 worldwide. Currently, CO_2 emissions per capita are almost three times as high. This means the available CO_2 budget would be exhausted within 30 years and not last until 2100.

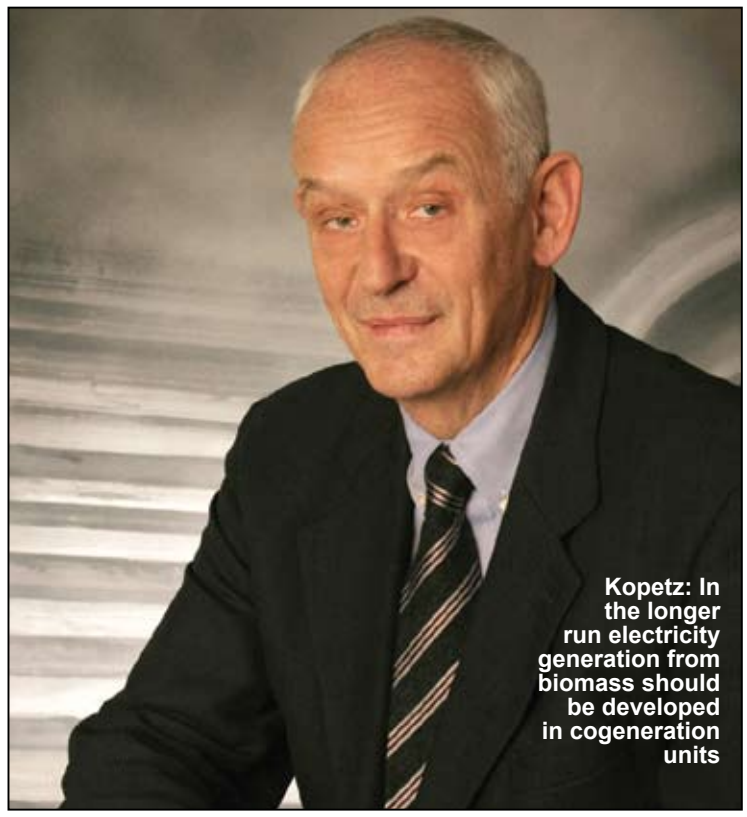
In preparation of the upcoming Paris climate Conference of Parties (COP 21), countries were invited to propose pledges concerning the reduction of GHG emissions on a voluntarily basis until spring 2015. Not all countries followed this call. The countries that submitted their pledges in time are only responsible for 34 per cent of global emissions.

These Intended Nationally Determined Contributions (INDCs or pledges) submitted by May 2015 are not enough. As calculations by IEA show on the basis of these pledges, the carbon budget for this century would be consumed by 2040. Therefore the 2°C target can only be achieved if a much faster transformation of the energy system takes place within the coming two decades than expressed in these pledges. It can be concluded that Europe should reduce its emissions at least by 50 per cent and increase the share of renewables to 45 per cent by 2035.

But climate change is not the only major reason for increasing the use of biomass. The energy security issue surrounding gas supply must be a major consideration. Security of gas supply is a serious threat, especially to the heating sector.

On average Europe consumes 500 billion m³ natural gas per year, of which 35 per cent is used for the generation of electricity, 40 per cent for the heating of buildings and 25 per cent for industry and other purposes. Around 65 per cent of the total quantity is imported. Almost 30 per cent of Europe's gas supply comes from Russia (140 billion m³).

Gas plays an important role in the heating sector. By 2012 roughly 55 per cent of the demand for heat (around 200 billion m³) was based on natural gas. To put it simply: in Europe 40 per cent of the buildings are heated with imported natural gas. An interruption of the gas imports would mean that 200 million Europeans would sit in the cold.



Kopetz: In the longer run electricity generation from biomass should be developed in cogeneration units

The situation in electricity generation is different. In 2012 coal dominated power generation followed by nuclear and renewable electricity. Among renewables, hydropower leads the ranking (366 TWh) followed by wind (205 TWh), biomass (149 TWh) and solar (71 TWh).

In 2010 EREC, the European Renewable Energy Council published the study 'RE-thinking 2050', with targets for the development of all renewables and of bioenergy until the year 2030. The study proposes a pathway towards a 45 per cent share of renewables of the final energy demand in 2030.

According to this study the final contribution of biomass should develop from 77 Mtoe in 2007 to 226 Mtoe in 2030, this equals an annual growth of 4.7 per cent, a bit less than in the last two decades. The cited study is five years old. If made today some figures would be changed but the basic message would remain the same: a 50 per cent reduction of GHG emissions in the period 2030-2035 will require a share of biomass of around 20 per cent of the final energy consumption.

Whereas hydro, wind and photovoltaic only deliver electricity, biomass contributes electricity, heat and transport fuels. The lion's share of biomass, more than 70 per cent, goes to the heating sector.

The conversion of biomass to electricity always delivers heat as well. This heat is used (as process or derived heat) or lost. In any case the primary energy needed to generate electricity is bigger than the final energy delivered.

As a conclusion, a fast deployment of biomass according to the EREC concept would allow the replacement of 80 Mtoe of fossil-derived gas in 2030 – corresponding to 93 million m³ of gas. By 2030 biomass could replace two thirds of the present European gas imports from Russia. If all renewables are developed as presented, Europe would be independent of gas imports from Russia by 2030. This roadmap can only be achieved with a pro-active policy to increase the supply of biomass from Europe.

The supply and use of biomass should follow basic principles such as sustainability and efficiency. In the longer run electricity generation from biomass should be developed in cogeneration units to avoid heat losses and improve the efficiency. In many cases this will only be possible if municipalities construct district heating systems to create markets for the derived heat.

The import of biomass has played a growing role in the last years. Yet in the longer run if all continents have to reduce CO_2 emissions according to the 2°C target, most of the current exporting countries will need a big share of their biomass themselves. Therefore a more active European policy to foster the additional supply of biomass from Europe is recommended.

In the future, the demand for energy will grow in some parts of the world. The gap between a growing demand for energy and a required fast reduction of fossil fuels to mitigate climate change can be bridged by a rapid deployment of all renewable energies in all regions of the world and by better efficiency. At present only a few renewable energy sources, in only a few regions of the world are growing rapidly. This is not enough. All regions and all renewable energy technologies have to accelerate their growth in order to replace fossil fuels fast enough.

Heinz Kopetz is President of the World Bioenergy Association.

The final straight

Homes and businesses around the world already reap the benefits of rooftop solar energy systems but could benefit more if storage technologies were cheaper. Lithium-sulphur batteries could fit the bill and are fast approaching commercial viability.

Siân Crampsie

On a small patch of ground at a science park near Oxford, UK, a 3.8 kWp solar system quietly generates energy for use in nearby buildings.

The photovoltaic (PV) array is much like any other small-scale solar system, except that it forms part of a project that aims to demonstrate the commercial and technical viability of energy storage based on lithium-sulphur (Li-S) batteries.

Launched in June, the Helios demonstration project is a key part of Oxis Energy's plans to commercialise and certify its Li-S batteries, a technology that could become a launch pad for cheaper commercial solar energy across the world, says the firm.

The Helios project consists of 16 PV panels, two inverters and an Oxis 48 V, 3 kWh Li-S battery, and has been set up by Oxis in conjunction with ProInso, a specialist in the solar energy sector.

The battery stores excess energy generated by the solar panels and releases it when light levels drop. Installed in a home or business, the battery pack would enable the user to make greater use of their solar panels, or store energy generated during the day for use at peak hours.

Such solar energy storage systems also have possibilities in remote off-grid communities and in countries with emerging economies where grid reliability is a problem in homes, businesses and for establishments such as hospitals. In countries such as South Africa there is already a growing demand for residential storage solutions, according to Oxis and ProInso.

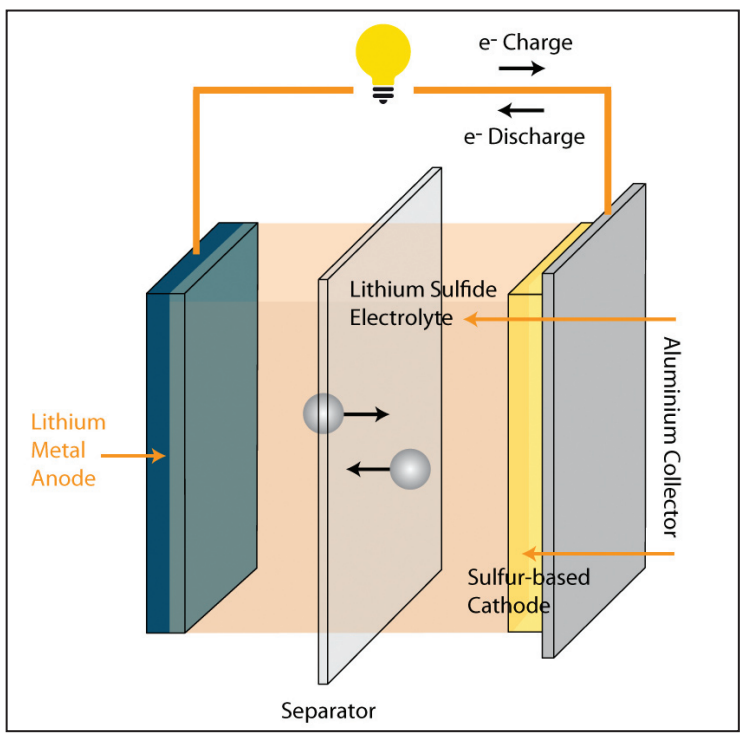
The falling costs of solar energy and battery-based storage solutions are already starting to create a market for solar storage solutions in the residential and commercial sectors. Earlier this year Tesla launched its Powerwall technology – a rechargeable lithium ion (Li-ion) battery for the residential and commercial sectors.

While Li-ion technology is coming of age in terms of cost, there remain issues with its reliability, says Oxis. And while the manufacturing costs of Oxis' Li-S batteries are currently relatively high, the firm believes that costs will fall rapidly when commercial line production begins.

Li-S battery technology also has other advantages over Li-ion batteries, argues Oxis, including the fact that it is safer and has a better energy density. In addition, its use of sulphur – a cheap byproduct of the oil sector costing under $200/t – avoids the need for heavy metals, and Li-S cells have been shown to have 100 per cent depth of discharge. Li-ion batteries are already reaching the limit of their potential, says Oxis, while Li-S technology is on the cusp of commercialisation and holds great promise.

Oxis' Li-S battery cells comprise a lithium metal anode, a sulphur-based cathode that includes carbon and a polymer binder, and a non-flammable electrolyte. Their light weight, high energy density and low material costs will make them a cost-effective energy storage solution for a range of applications, including solar storage, and use in the military, aviation and ground transportation sectors.

Oxis' Li-S battery stack: the company intends to manufacture a 3 kWh battery pack that is modular so that several units can be stacked. Commercial launch is expected in 2016



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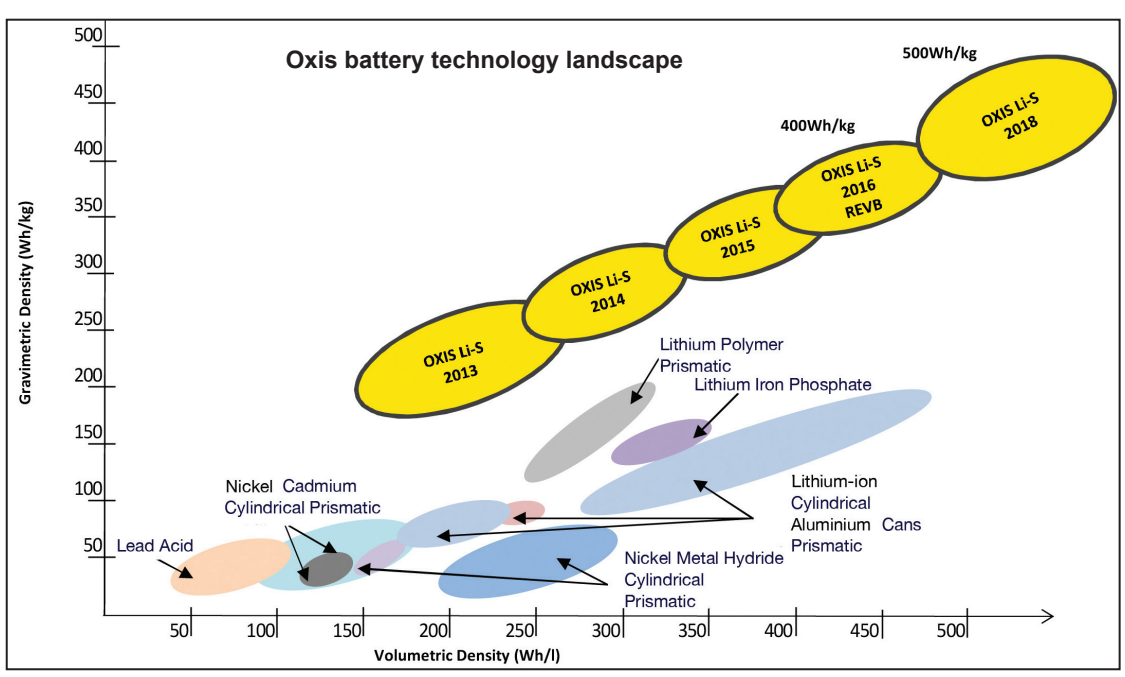

According to Oxis, sulphur is a good cathode partner for metallic lithium and, in contrast with conventional Li-ion cells, the chemicals processes include dissolution from the anode surface during discharge and reverse lithium plating to the anode while charging. As a consequence, Li-S allows for a theoretical specific energy in excess of 2700 Wh/kg, which is nearly five times higher than that of Li-ion.

In 2014, Oxis Li-S technology achieved an energy density of 300 Wh/kg. The company is forecasting that it will achieve 400 Wh/kg in 2016, and is aiming to achieve >500 Wh/kg in the next five years. The cells in use at the Helios demonstration are 10 Ah cells, and Oxis is also working to increase cell capacity to 30 Ah and even 90 Ah.

Production of Oxis' battery cells is currently undertaken by a licensee, Singapore-based GP Batteries, a major manufacturer of primary and rechargeable batteries and the largest consumer battery manufacturer in China. As demand for its products rise, Oxis says it will step up production of its cells, a factor that will help to reduce costs.

Oxis is working with a range of other industrial partners including chemical companies such as Arkema, mainstream lithium manufacturing firms and universities such as Cranfield and Imperial College to further develop its battery technology. Specific research areas include improved battery cells, solvents, additives, cycle life and protective coatings to improve performance and reduce costs.

The predicted costs of Li-S batteries when production is ramped up is lower than those of competing Li-ion technologies, says Oxis, which has set itself a target of $250/kWh at the battery level by 2020. The firm has carried out a detailed analysis of costs as it increases production levels and believes that this target is achievable. One of the main cost advantages of Li-S technologies is that its high gravimetric energy density means that less material is required to make battery cells for a given output compared to other battery technologies.

At its base at the Culham Science Centre, Oxis' Helios demonstration project represents one of the final steps to commercialisation of Li-S technology. The demonstration will run until the end of the first quarter of 2016 and enable Oxis to carry out tests on its battery system operating in a 'real world' situation. The firm says that Helios will, in particular, give it a better picture of its battery's cycle life, which laboratory tests have shown to be around 2000.

Commercial launch of Oxis' Li-S battery is expected in 2016 and the firm is hoping that the residential and commercial rooftop solar sector in the UK and other parts of Europe will be a key market.

There are over 1 million residential solar rooftop installations alone in the UK, and the government is also attempting to stimulate the commercial rooftop sector, which has been slower to grow. Overall in Europe, approximately two-thirds of the region's installed solar PV capacity of 81 GW is rooftop-mounted. Oxis says that its battery system can be easily retrofitted to existing solar schemes. Its intention is to manufacture a 3 kWh battery pack that is modular so that several units can be stacked up to meet the varying size needs of potential customers.

Oxis says that it is also keeping an eye on the large-scale ground-mounted solar sector. Batteries would enable large-scale solar farms to provide peak shaving services by shifting their output to the peak hours of 17:00-19:00. In addition they could help developers that have been offered limited-capacity grid connections by distribution network operators in regions with grid constraints, enabling them to offload their energy in two stages.

The revenue streams to be gained by operators of large-scale solar farms currently would not justify battery investment, says Oxis, but as costs fall, opportunities in this market segment could arise.

Avoiding Waterloo

Junior Isles

There is a revolution going on – a market structure that has existed for decades is undergoing unprecedented change. With many of Europe's utilities under severe pressure, the key theme at this year's Eurelectric Annual Convention and Conference was therefore: 'The consumer powered energy transition'.

Opening the conference, Johannes Teyssen, CEO of E.On and outgoing President of Eurelectric said: "… the competitive market structure of our sector over the last decade has been reversed through the commercialisation of new distributed and zero-marginal-cost technologies. And unlike Napoleon – who defined a revolution as an idea taken up by bayonets – I would suggest that this idea was taken up by our consumers and innovators as a silent but nevertheless radical revolution. This has had a massive impact on our business."

He noted that traditional value chains are breaking down and that utilities' new business would be based on energy solutions as opposed to "electrons and molecules". As consumers seek ways to reduce electricity bills, utilities will focus on changing behavioural patterns and increasingly look towards delivering energy management solutions, he said.

Eurelectric is therefore calling for policies that "empower" customers. Teyssen added that policies should keep consumer "bills in check… and be transparent so they know what they are paying for".

Eurelectric noted that the European Commission is coming forward with new proposals on downstream market design, which it sees as crucial because "customers will lead the change".

Yet one has to ask whether much of this talk of engaging customers and consumers leading the revolution is primarily a PR exercise to restore battered public image?

Alex Laskey, President and Founder of OPower, does not believe it is. "I think it's the real deal," he said. "I think the oil companies sending in a letter to the UN saying that they want carbon trading is PR."

He explained: "There are very few industries on Earth any longer that can grow and sustain businesses without a relationship with customers and utilities are no longer in that camp."

There are three fundamental reasons why they need customers, argues Laskey.

> "...this idea was taken up by our consumers as a silent but nevertheless radical revolution

Firstly, electricity demand is flat or declining for the first time in over 100 years. On top of this, efficiency is taking hold and renewables are impacting conventional generating sources. "If, no matter what you do, customers continue to buy more and more of your product, then you don't really need to have a relationship with your customers because your product sells itself," noted Laskey.

Secondly, for over 100 years utilities knew that customers were dependent on a centralised power system. That is no longer the case. With low-cost solar and cheap and reliable storage on the horizon, there is now the very real prospect that some customers can leave the utility.

Thirdly, in the past utilities have been able to depend on a relatively homogeneous customer base. Everyone wanted the same thing – reliable, cheap electricity. Today, some will pay extra for 'green' electricity, while others may want to produce their own electricity but also have the capability to sell electricity back to the grid ('prosumers').

Laskey commented: "All of these things are creating differentiated and unique customers… so you have to give them the unique set of services and products they want."

These three fundamental changes, which have taken place over the last 5-10 years, have come to a head since the recession and perhaps there is now truly a need for utilities to get close to their customers.

António Mexia, CEO of EDP and the incoming President of Eurelectric said that customer engagement would be one of five main themes on which Eurelectric would focus under his presidency over the next two years.

He noted that the sector has been under heavy criticism for a number of years, often blamed for being a deadweight on economic competitiveness, being a major leader in polluting, providing a poor service to customers and being disconnected from their needs.

"A lot of this criticism is unfair," he said but conceded that a part of it was caused "by a sort of denial – a disconnect from the reality that the sector was in". For example, some regarded renewables as merely marginal and uncompetitive for distributed electricity needs. Others thought of customers as passive takers of their services.

Mexia said that utilities might not be completely over this stage yet and stressed they need a clear vision of what the energy sector needs.

In mid-June Eurelectric published a paper called: 'Prosumers – an integral part of the power system and the market', which states that it "supports customer empowerment, and the active role of customers in the electricity market".

One of the messages it is pushing is that a stable and market-based regulatory framework properly values electricity and stimulates innovation, thus enabling companies to develop products and services for prosumers.

In the paper, Eurelectric makes a number of recommendations for reforming the regulatory regimes:

- Opting for distributed generation should be a customer choice that does not result from artificial incentives.
- Prosumers should be integrated into the market and the power system: indirect subsidies, such as non-market-based net-metering schemes and socialising of prosumers balancing costs should be avoided, as well as other schemes preventing market integration. Support schemes should be designed so as to be cost-efficient and avoid market distortion.
- Prosumers should contribute to the network cost recovery in the same way as other customers. Network charging for small and medium size customers, including prosumers should evolve towards more capacity-based network tariffs to ensure that customers pay for the grid they use.
- DSO regulation should facilitate investments in smart grids to allow the integration of prosumers to the power system and market.
- The use of the electricity bill to collect (non-energy related) taxes and levies should be avoided, as this hampers the sound development of the electricity market for consumers and prosumers. The level of taxes and levies should also be reconsidered – these have increased recently, and often form a considerable part of the electricity bill.

Reinforcing the focus on retail and anticipating the needs of the customer, is seen by some as an essential step that traditional utilities are incapable of executing effectively and will therefore be a nail in their coffin. But Mexia disagrees.

"Many of the news pieces about our sector that we read today have one underlying tone," he said, "given the new players coming into retail, we are faced with the death of utilities… as the famous quote goes: the reports of our deaths are greatly exaggerated. Competition drives us to be innovative in a way that we are better able to serve our customers… We must show increasing examples of where utilities and new players are teaming up to meet our customers' needs."

Certainly utilities will need to team up. There is significant change in all areas of the traditional value chain and the speed of change is tremendous. To be a specialist in all the necessary areas is probably too big a challenge for the traditional utility. It is no longer just up to them to shape the industry.

As Teyssen put it: "There are too many involved in the game: there are customers, aggregators, innovators others in the industry that are all part of the value chain. This industry will be changed, but not just by one traditional player. It's like a big picture; everybody will add some colour to it but if you claim you want to do the art alone, then you will probably be very soon alone in the room."

It is an interesting analogy and sound advice – 200 years too late for Napoleon but not too late for today's utilities to avoid their Waterloo.