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Anaerobic digestion has multiple benefits but aligning government policies is critical for sustained growth. *Page 13*



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Mexico's energy sector to become "engine" for growth



Enrique Peña Nieto: "The energy reform will allow us to take advantage of our natural resources in a sustainable way"

Long awaited energy reforms look set to attract foreign investment, bringing a boost to the Mexican economy, writes Junior Isles

Mexico could be "poised for an energy renaissance" following the enactment of new energy reform legislation by President Enrique Peña Nieto. A recent report by US think-tank the Atlantic Council concluded that the reforms allow for a "compelling framework for growth across the energy sector" with the government predicting over \$50 billion in new investments between now and 2018.

The reforms signed into law last month come more than 75 years after Mexico expropriated its oilfields from foreign companies in the name of revolutionary nationalism.

Approval by both the Lower Congress and the Senate completes the legislative process required to end state-owned Pemex's monopoly and, in the process, open up the energy sector to foreign investment and expertise.

International oil majors like Royal Dutch Shell and ExxonMobil have been monitoring the legislative process and are widely expected to compete for newly established development contracts and licenses as early as next year.

"Mexico has created a solid framework to make the energy sector more competitive and attractive to private

investment," said Shell Mexico President Alberto De La Fuente.

Following the announcement MX Oil plc, the AIM-listed oil and gas company focused on the re-opening Mexican energy sector, said it was "pleased" Peña Nieto has approved legislation required to re-open Mexico's vast energy industry to the private sector.

The company also noted the government's intention to announce the oil fields which state-owned Pemex will retain for production, known as 'round zero', on 13 August 2014 rather than 17 September 2014, thereby allowing

contracts to be awarded to the private sector as early as the first quarter of 2015.

Following the enactment, Mexico's President Peña Nieto said the legislation would ensure the energy sector again becomes an engine for economic growth, by guaranteeing the supply of oil, gas and electricity at competitive prices.

In an article written for the *Financial Times*, he said: "Today we are the world's 10th-largest oil producer and our recoverable shale gas resources rank sixth. The energy reform will

Continued on Page 2

Policy uncertainty threatens renewable energy momentum

The expansion of renewable energy will slow over the next five years unless policy uncertainty is diminished, says a new report by the International Energy Agency (IEA).

Speaking at the launch of its third annual *Medium-Term Renewable Energy Market Report*, IEA Executive Director Maria van der Hoeven said: "Renewables are a necessary part of energy security. However, just when they are becoming a cost-competitive option in an increasing number of cases, policy and regulatory uncertainty is rising in some key markets. This stems from concerns about the costs of deploying renewables."

"Governments must distinguish more clearly between the past, present and future, as costs are falling over time," she added. "Many renewables no longer need high incentive levels. Rather, given their capital-

intensive nature, renewables require a market context that assures a reasonable and predictable return for investors. This calls for a serious reflection on market design needed to achieve a more sustainable world energy mix."

The report stated that power generation from renewable sources such as wind, solar and hydro grew strongly in 2013, reaching almost 22 per cent of global generation, and was on par with electricity from gas, whose generation remained relatively stable.

Global renewable generation is seen rising by 45 per cent and making up nearly 26 per cent of global electricity generation by 2020. Yet annual growth in new renewable power is seen slowing and stabilising after 2014, putting renewables at risk of falling short of the absolute generation levels needed to meet global climate change objectives.

Non-OECD markets, spurred by diversification needs in many countries and increasing air quality concerns in China, in particular, comprise almost 70 per cent of the growth.

For the first time, the annual report provides a renewable power investment outlook. Through 2020, investment in new renewable power capacity averages over \$230 billion annually – lower than the approximated \$250 billion invested in 2013. The decline is due to expectations that both unit investment costs for some technologies will fall and that global capacity growth will slow.

Commenting on the falling unit investment costs, Paolo Frankl, Head of the IEA Renewable Division noted: "The falling renewable investment costs is a real success story. Generally all technologies are falling over a six-year period, with the exception of

offshore wind. The most dramatic decrease is in solar PV."

Notably, the IEA's forecasts on solar take into account the potential impacts of the ongoing anti-dumping disputes and subsequent duties imposed on solar panels from China.

Michael Waldron, Senior Energy Analyst in the IEA's Renewable Energy Division and author of the report, said: "Sometimes trade actions may not be announced or confirmed, and play-out over certain period of time. We do our cost analysis in one chunk. We try to account for the uncertainty, not by attributing anti-dumping duties to specific geographies, but by being more cautious overall in terms of module price movements generally, particularly in the near term."

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allow us to take advantage of our natural resources in a sustainable way, while observing basic principles of sovereignty.”

One piece of Mexico's energy reform is a new electricity law that should, within two years, create a competitive power market managed by an independent system operator.

Essentially it will break up the electricity generation and distribution monopoly of Comisión Federal de Electricidad (CFE), and thus reduce costs. Carlos Serrano, chief economist for Mexico at BBVA Bancomer estimates that the change will result in a 40-50 per cent decrease in Mexico's electricity costs.

The government also wants to build more natural gas-fired plants, to reduce costs. Mexico has high electricity rates, which officials say limits the growth of some businesses. Mexico currently spends about \$11.40/MWh on electricity for industrial uses, according to the International Energy Agency. The US, meanwhile, spends about \$6.60.

Mexico expects to put out for bid \$4.9 billion in electrical generation and natural gas pipe-line projects as part of the opening of the energy sector. Some of the pipelines would be built in Texas, to take advantage of cheaper US gas.

“Natural gas is the linchpin of the energy reform,” explained David Goldwyn, former US State Department special envoy and coordinator for international energy affairs, in the Atlantic Council report. “The key to delivering lower cost and more reliable electric power to Mexico is increasing access to natural gas first by pipeline from the US, and then over time from indigenous production.”



Ochoa says new power plant bids will be open to foreign investors

The Federal Electricity Commission wants to build several power plants but has not set a date for the opening of bidding. Commission director Enrique Ochoa said the bidding will be open to private and foreign firms.

Although reports have focused on oil and gas, the legislation includes significant changes for renewable energy as well.

In addition to creating a new independent role for grid operator CENACE, the legislation has requirements to procure renewable energy; enables companies to directly sign electricity contracts with renewable energy generators; and mandates the creation of a system of renewable energy certificates.

“Overall it's going to be a positive thing for renewables energy generally, and for solar in particular,” said GTM Research solar analyst Adam James. “One of the main reasons is that generation will now be procured on a competitive basis. It's going to be a liberalised market where solar developers can come in as independent power producers and develop projects.”



- Funding for 17 US nuclear research laboratories
- Georgia approves additional Vogtle expenditure

Junior Isles

US Energy Secretary Ernest Moniz is urging politicians and leaders in the energy industry to make nuclear power part of their strategy to help minimise global warming.

Repeating the Obama administration's 'all of the above' energy strategy at an energy summit in Idaho last month, Moniz said that funding and improving the nation's 17 nuclear research laboratories must also become a higher priority.

“The United States isn't shunning coal or oil energy sources. Instead, officials are finding ways to reduce their carbon emissions,” he said.

Energy Secretary Moniz said the US Department of Energy would award \$67 million in funding for nuclear research and development to a number

of universities and labs across the country. Idaho will receive \$3.7 million for six projects at the Idaho National Laboratory, Boise State University and Idaho State University.

“I'll be honest, there used to be a time where we thought of labs as places to execute tasks,” he said. “And they really need to take more of a strategic role. We're having some success with that ... We want the labs to have a regional footprint.”

Moniz acknowledged the nation's nuclear labs were built decades ago with little improvement since but remained optimistic about the future growth of nuclear energy.

The USA currently has 100 nuclear power reactors and while there are plans for a number of new reactors, the prospect of low natural gas prices continuing for several years

has dampened these plans.

Four new reactors are currently under construction in the country – two new reactors at the V.C. Summer Nuclear Station site in Fairfield County, South Carolina and two at Plant Vogtle in Georgia.

Last month the Georgia Public Service Commission unanimously approved an additional \$389 million in expenditures for Georgia Power's two reactors under construction at Plant Vogtle while at the same time declining a request to require new water conservation measures at the plant.

The expenditure approval, which covered all of 2013, brings the total construction cost verified to date to \$2.599 billion.

Georgia Power now predicts Vogtle's Unit Three will begin commercial operation in late 2017, and Unit Four

will begin operation during the fourth quarter of 2018. The original dates were April 1, 2016, and April 1, 2017. The expansion is more than \$1 billion over budget.

■ Westinghouse Electric Company and Blue Castle Holdings last month signed a memorandum of understanding to pursue the development of a two-unit AP1000 nuclear power plant at the Green River site in Utah.

Under the agreement, the companies will work together to develop a scope of activities for enabling the Blue Castle Project under a definitive agreement, including marketing, nuclear safety licensing, permitting, design, engineering, procurement, construction, installation, commissioning, startup, testing, nuclear fuel, refueling, operation and maintenance of the two-unit plant.

Power Africa Initiative gathers momentum

- World Bank pledges \$5 billion
- Obama announces additional \$7 billion in credit lines

Investment in Africa is gathering pace with the announcement of billions of dollars in funding at the first US-Africa summit held in Washington last month.

The World Bank announced a \$5 billion (Sh435 billion) support package for the US-led Power Africa Initiative while Sweden pledged \$1 billion, taking the total money leveraged for the initiative so far to \$26 billion.

World Bank president Jim Yong Kim told the US-Africa Business Forum of the US-Africa Leaders Summit that the support would be in the form of direct financing, investment guarantees and advisory services for project preparation.

US President Barack Obama said that the US has already committed \$7 billion (Sh609 billion) to the initiative that seeks to step up and double electricity generation and transmission in sub-Saharan Africa. He added that an additional \$7 billion in credit lines to promote US exports would be

made available annually.

The five-year presidential initiative launched by Obama in July last year seeks to help plug Africa's 100 GW power gap that has seen 85 per cent of its rural population living in the dark.

The six African countries in the first phase of the project, which aims to inject more than 10 000 MW of electricity into their national grids, are Ethiopia, Ghana, Kenya, Liberia, Nigeria and Tanzania.

Specific goals of the initiative include reduction of power cost that stands at over \$0.75/kWh to attract industrial investors to the continent and create jobs for its ballooning young population.

At the summit Standard Bank Group, Africa's largest lender by assets, renewed its commitment to the initiative.

Standard Bank is using its extensive balance sheet and on-the-ground presence across 20 markets across sub-Saharan Africa to help finance projects

under the Power Africa initiative while at the same time actively leading the policy reform process required to facilitate increased private sector investment in Africa's power sector. The bank expects more than \$1 billion in commercial projects to be realised across the six Power Africa partner countries by 2018, and as much as \$5 billion when including the rest of sub-Saharan Africa.

“We are seeing an increasing pipeline of power projects across sub-Saharan Africa,” said Mr Sim Tshabalala, Chief Executive of Standard Bank Group. “In 2013 we committed to arrange funding of at least \$150 million of debt in the near term across the Power Africa countries, while more recently that amount has risen to over \$400 million, principally in Kenya and Nigeria, with smaller transactions in Ghana and Tanzania.”

Meanwhile, General Electric Co. said it would invest \$2 billion in Africa by 2018, calling the continent its “most

promising growth region”.

Africa needs to add 300 GW of power generating capacity over the next 15 years in order to meet demand that is expected to grow at an average annual rate of 3 per cent over the next two decades. According to the International Energy Agency, sub-Saharan Africa requires more than \$300 billion in investment to achieve universal electricity access by 2030.

Over 650 million of Africa's 900 million population lack access to electricity and the aim of the initiative is to build on Africa's enormous power potential – including new discoveries of vast reserves of oil and gas, geothermal, hydro, wind and solar energy.

The continent has also been attracting investment from China. Li Keqiang, China's premier, announced during his first trip to Africa in May that Beijing would increase its bilateral credit lines to African countries by \$10 billion, bringing the total to \$30 billion for 2013-15.

Japan considers nuclear price support system

Japan's industry ministry says it will consider introducing a price support system for electricity generated by nuclear power to provide utilities with long-term revenue stabilisation even after the planned full liberalisation of the country's electricity market.

The system would enable nuclear plant operators to continue investment in new facilities and upgrade infrastructure even if electricity prices go down after the market is deregulated.

The move is being considered to address utility fears they may not be able to maintain the competitiveness of nuclear power generation when the 60-year regional monopolies of the electricity market come to an end.

As part of the shake-up of the country's electricity industry – following the 2011 nuclear accident at the Fukushima Daiichi nuclear power plant that exposed the vulnerability of the nation's grid – Japan will start opening up the

retail electricity sector around 2016.


A contract-for-difference type mechanism modelled on the British framework is being examined, where a strike price will be set reflecting the massive costs for decommissioning of a nuclear plant and the management of spent fuels. When the market price falls below the strike price, the government would make up the difference.

Some observers argue, however, that the move could contradict the

government's promise to reduce its dependence on nuclear power in the wake of the Fukushima accident.

Japan recently said it would decide the percentage of electricity to be generated by nuclear power by late 2015 in time for the COP21 climate conference in Paris.

In a revised national energy plan adopted in April, Prime Minister Shinzo Abe declared nuclear power an “important base-load power source”.





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Clean coal projects inch forward as legislation tightens

Progress on advanced clean coal plants will be a crucial bellwether for gasification and carbon capture technology as the US plans to tighten controls on emissions from power plants.

Siân Crampsie

Mississippi Power says that it is preparing to mark a series of major milestones at its landmark Kemper County clean coal project over the coming months.

The utility last month put the IGCC plant's combined cycle unit into commercial operation using pipeline natural gas and says that it has also carried out pressure testing of the plant's two gasifiers. The first gasifier heat up is scheduled for later this year.

The \$5.5 billion project, which includes a carbon capture element, has been beset by controversy because of delays and cost overruns. Mississippi Power says that the plant is on track to start operating fully in the second quarter of 2015.

The Kemper plant will also pipe captured carbon dioxide to oilfields for enhanced oil recovery. It will capture at least 65 per cent of the carbon dioxide produced, with resulting carbon emissions comparable to a similarly sized natural gas plant.

With the combined cycle unit currently operating, the Kemper plant is producing around 700 MW. The unit was originally synchronised to the grid in October 2013 and has undergone 11 months of critical testing.

Mississippi, part of Southern Company, is keen to prove the credentials of the 582 MW plant, which it sees as an important investment in a low-carbon future. US President Barack Obama is pushing ahead with proposals to limit carbon dioxide emissions from new and existing power plants,

a policy that the country's coal lobby fears could spell the end of coal-fired power generation.

In June the Environmental Protection Agency (EPA) unveiled proposals to limit greenhouse gas emissions from existing power plants, a move that pressure groups such as the American Coalition for Clean Coal Electricity (ACCCE) said would lead to the closure of up to 69 GW of coal-fired generating capacity in the country.

Last year, Duke Energy commissioned its 618 MW Edwardsport IGCC power plant in Indiana. Earlier this year Duke reported operational problems at the plant due to an "equipment challenge".

Edwardsport is the largest plant of its kind in the world to use gasifica-

tion technology on this scale and cost \$3.5 billion to build, far more than the original \$1.9 billion cost estimate.

In April this year Southern Company said it would take a \$380 million charge in the first quarter of 2014 to reflect rising costs at Kemper. The project was also beset by labour issues and construction problems in the spring, "due in large part to adverse weather, unexpected excessive craft labour turnover and unanticipated installation inefficiencies", Mississippi Power said.

Other clean coal projects in the US include FutureGen 2.0 and a project led by Petra Nova to retrofit carbon capture technology to a coal fired power plant in Texas.

In July Petra Nova, a joint venture of Petra Nova Holdings LLC (a subsidiary

of NRG Energy, Inc.) and JX Nippon Oil Exploration Limited (a subsidiary of JX Nippon Oil & Gas Exploration Corporation), extended a contract for Sargent & Lundy to provide engineering services for the project.

The Petra Nova project will be the largest commercial-scale post-combustion carbon capture retrofit in the world. It will capture 90 per cent of the carbon dioxide in the flue gas from the Parish plant near Houston and pipe the captured gas to a mature oilfield to boost oil production.

"The Petra Nova carbon capture project will make a significant contribution to expanding cost-effective options for reducing the environmental impact of existing energy resources," said Tom White, Chairman, President & CEO of Sargent & Lundy.

CPV closes St Charles finance

Use of an innovative financing structure has helped a consortium of power project developers reach financial close on a 725 MW gas fired combined cycle power plant in Maryland, USA.

Competitive Power Ventures (CPV), Marubeni, Toyota Tsusho and GE Financial Services have closed the financing on the CPV St Charles Energy Center, which will be built at a cost of \$775 million.

CPV used medium-term contract

financing through the commercial bank market to finance the project's debt, a package similar in structure to a second project – CPV Woodbridge Energy Center – financed late last year.

"Where very few commercial banks would consider lending to a project with such a profile just two years ago, CPV has helped evolve the lending market to where 10 lenders supported CPV Woodbridge and 15 participated in

CPV St. Charles," said CPV's CFO, Paul Buckovich. "The significant over-subscription of the CPV St. Charles senior debt package underscores the market's acceptance and appetite for innovative project finance structures."

CPV St Charles will be equipped with two GE 7F.05 gas turbines and a GE D400 steam turbine. The project will be constructed by SNC Lavalin Constructors Inc. and operated by EthosEnergy Power Plant Services, LLC.

US sets new solar tariffs

- Utility-scale schemes vulnerable to new duties
- SolarWorld welcomes DOC decision

Solar power project developers in the USA may have to find alternative suppliers of photovoltaic (PV) panels after the US Department of Commerce (DOC) proposed new anti-subsidy and anti-dumping rulings on some Chinese firms.

The DOC has proposed expanded penalties in a preliminary finding report that said that overseas producers, including Trina Solar and Taiwan's Gintech Energy Corp., sold goods in the US at unfairly low prices.

It has called for duties as high as 165 per cent for some Chinese manufacturers and 44 per cent for those from Taiwan, according to a DOC statement.

The US unit of SolarWorld AG welcomed the decision and said that it would "clear the way for the domestic production industry to be able to compete on a level playing field". It believes that Chinese firms had shifted production to Taiwan and other third countries in order to avoid duties imposed by the US government in late 2012.

However other companies in the solar industry believe that the long-running trade spat is harming the US sector.

"We strongly urge the US and Chinese governments to 'freeze the playing field' and focus all efforts on finding a negotiated solution," Rhone Resch, president of the Solar Energy Industries Association, said in a statement. "This continued, unnecessary litigation has already done serious damage, with even more likely to result as the investigations proceed."

Market analyst NPD Solarbuzz said

that more than 3 GW of the projects currently in the US solar PV project pipeline had been set to use Chinese modules. Half of this project pipeline is composed of large-scale ground-mounted solar projects and these projects may have to find other suppliers or potentially pay higher prices for their modules.

"Large-scale ground-mount PV installations are particularly vulnerable to cost increases and potential disruption, as many have signed power purchase agreements at aggressive rates," said Michael Barker, senior analyst at NPD Solarbuzz. "Any increase in cost for the projects could mean renegotiation, delay, or even termination."

The US solar PV project pipeline is now approaching 50 GW of commercial and utility projects and is expanding beyond states such as California and Arizona into areas such as Utah and Minnesota, where solar activity had until recently been minimal.

"Solar PV is rapidly becoming more cost-effective as a power generation source," said Christine Beadle, analyst at NPD Solarbuzz. "Project developers are swiftly adapting to new market dynamics and are driving strong growth, especially in community and carport systems, but this growth may be interrupted if any external factors increase prices significantly."

A final decision by the DOC will be made in mid-December. The independent US International Trade Commission will determine by the end of January whether US makers of the solar-power goods were harmed by the imports. If so, the duties will be permanent.

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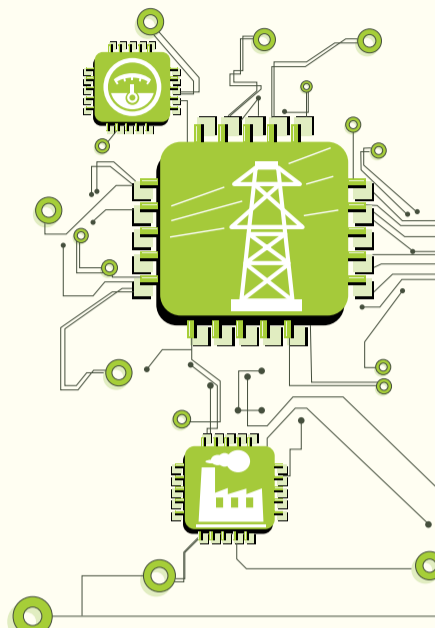
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Solar showpiece stalls in renewable push

- Political wrangling hits Sambhar Lake project
- India targets 1100 MW of new solar this year

Syed Ali

Objections to what has been billed as a showpiece for India's solar ambitions could be embarrassing for Prime Minister Narendra Modi, who has vowed to push renewable energy to help combat electricity shortages and reduce fuel imports.

Plans for setting up the world's largest solar power station have been hit by political wrangling over whether it can use the proposed land that is home to migratory birds and meant for salt production. The 4000 MW project was planned for the edge of the Sambhar Lake, India's largest salt lake, in the state of Rajasthan.

A senior official with India's federal Ministry of New and Renewable Energy said the project could still go through, despite objections raised by the state government.

To reduce energy import dependence and become greener, India is aiming to raise its solar generating capacity

to 20 000 MW a year by 2022, equivalent to about 5 per cent of its power needs from around 1 per cent today.

Last month Sh. Piyush Goyal, (Minister of state for Power, Coal & New and Renewable Energy (Independent Charge) stated that grid connected solar power plants of 2596 MW aggregate capacity had been commissioned during the last three years across the country.

The Minister further stated that about 150 MW of solar capacity taken up under MNRE schemes is expected to be commissioned during the current financial year. The overall target for the year is 1100 MW.

Notably, in August Vikram Solar Pvt., an Indian panel maker, won a contract to build the country's first floating solar power plant on a lake in eastern India. The 15 kW pilot plant will be constructed by December on top of a 130 m² platform anchored to the lakebed next to Kolkata's New Town Eco Park, said S.P. Gon Chaudhuri, a

member of the governing body of the West Bengal Renewable Energy Development Agency.

India's solar sector received a major boost with the recent news that the Delhi Electricity Regulatory Commission was expected to give the go-ahead for rooftop solar power generation in Delhi.

Following final approval of the policy, the Delhi government will initiate installing solar plants on government buildings, colleges and hospitals. This might later be followed at individual household level.

Delhi has about 250 to 300 sunny days available in a year and can have an average solar installation of 5.31 kWh/day/m². "If somebody wants to generate solar power for their own purposes, they may do so and, if they produce more, they can have an arrangement with their power supplier to send the excess power to the distribution grid," DERC chairperson P.D. Sudhakar said.

Beijing to ban all coal use as China steps up solar focus

Beijing says it will ban all coal sales and use by the end of 2020 as part of its fight against pollution.

The Municipal Environmental Protection Bureau says the city will instead prioritise electricity and natural gas, especially for heating.

In September last year, the Chinese government announced a ban on all new coal-fired power plants around Beijing, Shanghai and Guangzhou. Instead, the country has been working to increase the share of non-fossil fuelled power generation, including hydropower, wind power, solar power and nuclear power.

In August the central energy authority unveiled its photovoltaic (PV)

development targets for 2014, vowing to install 13 GW of new PV power capacity this year.

The target is more ambitious than the State Council guideline released in July 2013, which outlined plans to install 10 GW of PV generating capacity every year from 2013 to 2015.

China's new grid capacity stood at 3.32 GW in the first half of 2014, more than the total amount of new capacity installed in 2013.

Of the new capacity, 2.33 GW came from solar power plants and 0.99 GW from distributed solar projects, according to the National Energy Administration.

Australia power glut

Australia faces an unprecedented oversupply of energy with no new generation needed for 10 years, according to an industry report.

"For the first time in the history of the National Electricity Market, no new thermal baseload electricity generation is required over the next decade... due to the continuing decline in electricity consumption," Australian Energy Market Operator said in the report released in August.

AEMO estimated that for the next year alone, Australia will produce up to 8950 MW of surplus generation capacity, about 90 per cent of it in New South Wales, Queensland and Victoria.

"Even with 10 years of consumption growth, by 2023-24 between 1100

MW and 3100 MW of capacity could still be withdrawn from each of New South Wales, Queensland, and Victoria without breaching the reliability standard," it said.

"Electricity consumption from the grid has continued to decline in 2013-14, and this has contributed to an oversupply of generation capacity in the NEM," it said.



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Philippines accelerates power projects

The Philippines is accelerating several key projects in an effort to stave off looming power shortages.

In response to a request from the Department of Energy, Australian company Energy World Corp. (EWC) will strive to commence commercial operations of the first 200 MW of its 650 MW natural gas power plant in Pagbilao, Quezon in early 2015.

EWC chief executive officer Stewart Elliott said the 2 x 200 MW gas turbines manufactured by Siemens have already been shipped and are scheduled to arrive in the Philippines in September and October.

Lopez firm First NatGas Power Corporation (FNPC) will also be accelerating the construction of its second phase \$500 million Santa Maria gas plant to meet its targeted commercial commissioning by March 2017.

"That's another 414 MW. So construction will start next year. So what we have to do is construct it next year and complete it by 2017," First Gen president and chief operating officer Francis Giles B. Puno.

First Gen Chairman Federico R. Lopez noted that they are also aiming "to get San Gabriel power plant up and operational by the first half of 2016, in time to ease the projected tightness in energy supply".

At the start of August diversified conglomerate San Miguel Corp., (SMC) through its power generation subsidiary SMC Global Power Corp., said it is on track to add 900 MW of coal-fired capacity by 2016 and 2017 to help address the looming power shortage.

This new generation will come from the Limay, Bataan plant with a


capacity of 600 MW while another 300 MW will originate from the Malita, Davao plant.

The government has also granted approval for SN Aboitiz Power's (SNAP) to start construction of its 350 MW hydroelectric power facility in Ifugao, the first major project under SNAP's Greenfield Development Program.

The integrated hydropower complex is composed of three facilities: the 100 MW Alimit plant, the Alimit 240 MW pumped storage facility and the 10 MW Ollicon plant.

Meanwhile Aboitiz Power Corp. has said it is on track to start commercial operations of its 300 MW Therna South coal-fired power plant in Davao in the first half of 2015. Completion of the project will help alleviate the effects of power shortages on the island of Mindanao.

Europe News



MeyGen secures tidal funding package

- Tidal Energy Ltd prepares for DeltaStream demo
- BNEF cuts marine energy outlook

A deal securing finance for the world's largest tidal stream development will act as a catalyst for the global tidal power market, according to the project's developers.

Atlantis Resources has agreed terms for a finance package funding the construction of the first phase of the 398 MW MeyGen project, located in the Pentland Firth, Scotland.

The £50 million package from a syndicate of backers will fund the initial stage (phase 1A) of MeyGen and signals the transition of the tidal industry from demonstration projects to commercial arrays, said Atlantis.

It was announced in mid-August, just two weeks after Tidal Energy Ltd (TEL) unveiled the first full-scale tidal energy generator to be installed in Wales.

The Renewable Energy Association (REA) said that these latest developments showed that ocean energy firms were "racing" to deploy their devices, often in multi-unit arrays. "When that happens the sector will move into mass production, costs will fall dramatically, and wave and tidal will be well on their way to becoming major players in the UK energy system," commented REA CEO Dr. Nina Skorupska.

Recent analysis from Bloomberg New Energy Finance (BNEF) indicates that technology development in

the wave and tidal sectors was taking longer than expected due to high costs, setbacks and investor fatigue.

The market analyst firm has reduced its outlook for wave and tidal stream plants, with the latter now forecast to reach a global installed capacity of 148 MW by 2020, 21 per cent less than previously estimated. It cut its forecast for the wave energy sector by 72 per cent to 21 MW by 2020.

"Caution is necessary," said Angus McCrone, senior analyst at BNEF. "Taking devices from small-scale demonstrator stage to the pre-commercial array stage is proving even more expensive and time-consuming than many companies and their investors expected."

REA maintains that the UK remains the world leader in developing marine renewable energy, with three multiple tidal stream array schemes in the pipeline with the backing of major utilities and OEMs. "Once arrays of multiple devices are proven at scale, which is just around the corner, we will also be able to tackle the finance challenge," said REA Head of Marine Renewables Dr Stephanie Merry.

Merry added: "There'll be less perceived risk for investors and the economies of scale on the larger projects will make them economically competitive with other forms of low

carbon generation. These technologies can deliver reliable clean power from our seas for this generation and several to come."

Atlantis' MeyGen scheme will eventually include up to 269 turbines. Phase 1A will comprise four 1.5 MW turbines, with construction starting in 2014 and first electricity anticipated by 2016. The complete phase 1 of the project will consist of 61 turbines delivering 86 MW.

The project is the first large-scale tidal scheme in the world to successfully reach a funding agreement. The funding syndicate includes Atlantis, the UK's Department of Energy and Climate Change, The Crown Estate, Scottish Enterprise, and the Highlands and Islands Enterprise.

The finance package includes a combination of equity, debt and grants, and 60 per cent of the project cost will be invested in the UK supply chain. Significant project supply chain partners will include ABB, Andritz Hydro Hammerfest, Global Energy Group and James Fisher Plc.

In Wales, TEL will deploy a DeltaStream tidal stream device in Ramsey Sound, Pembrokeshire. The 400 kW demonstrator will be monitored and tested for 12 months after which TEL will join forces with Eco2 Ltd to install up to nine DeltaStream devices.

Offshore sector targets O&M costs

Collaboration is the key to improving performance, say firms.

Siân Crampsie

Eight major offshore wind energy companies have joined forces in a bid to reduce the cost of energy from the sector.

The eight firms have joined the Offshore Renewable Energy Catapult (ORE Catapult) and are aiming to make improvements in operations and maintenance of offshore wind farms and drive the industry towards a goal of £100/MWh for energy generated.

E.ON, SSE, EDF Energy Renewables, Scottish Power Renewables, Centrica, Dong, Vattenfall and RWE have signed up to participate in ORE Catapult, which was established by the UK's Technology Strategy Board to build knowledge and expertise in offshore renewables.

The eight firms have agreed to identify areas where they can collaborate and innovate, share learning and best practice to improve performance and ultimately drive down costs, a key goal for the sector. They will investigate the common issues that affect offshore wind farm performance and reliability, and develop and test innovative potential solutions.

Such areas include blade erosion and cable damage and failure, which have been identified as common problems affecting almost all operational wind turbine generators in UK waters.

In addition to improving operation and maintenance performance, the industry is also looking increasingly to

large-scale wind turbines to improve efficiencies.

Dong last month reached a conditional agreement with MHI Vestas Offshore Wind to purchase thirty-two 8 MW offshore wind turbine units for installation at the Burbo Bank Extension project off the northwest coast of England.

The agreement will become the first commercial order for MHI Vestas' V164-8.0MW offshore wind turbine, once the final investment decision has been taken.

"Larger and more cost efficient wind turbines are key elements in the realisation of Dong Energy's strategy towards reducing the cost of electricity from offshore wind," said Samuel Leupold, Executive Vice President at Dong Energy.

Dong reported last month that the first of 35 Siemens 6 MW wind turbines have been successfully installed at the Westermost Rough wind farm.

The 210 MW project represents the first commercial-scale use of Siemens' 6 MW unit. Dong said that it was "a step-change in our ability to provide more energy output from fewer turbines".

At the end of July Dong and Centrica announced that they had cancelled plans to develop the 4.2 GW Celtic Array offshore wind farm in the Irish Sea Zone, citing the challenging ground conditions as making the project economically unviable.

China invests in Italian grid

China is continuing its drive to purchase European assets from cash-strapped utilities with a deal to buy a 35 per cent stake in Italy's electricity grid.

The board of Italy's state holding company Cassa Depositi e Prestiti (CDP) has given the green light for the sale of the stake to China's State Grid Corp for €2.1 billion.

The deal is part of Italy's privatisation drive and follows months of negotiations by Chinese investors with the Italian government. Chinese state funds have also purchased small stakes in some of Italy's largest state-controlled companies, including Eni and Enel.

In May, Shanghai Electric also agreed to buy a 40 per cent stake in Treasury-controlled Ansaldo Energia, a mid-sized Italian energy company.



Westinghouse seals Kozloduy agreement

- Equity stake in seventh Kozloduy reactor
- SNC Lavalin signs Cernavoda deal

Westinghouse says that it will issue a competitive tender "within the next year" for the construction of a nuclear plant in Bulgaria after the US nuclear firm signed an agreement sealing its participation in the project.

Westinghouse has signed a shareholder agreement with Bulgarian Energy Holding EAD (BEH EAD), Kozloduy NPP plc and Kozloduy NPP-New Builds plc for the expansion of the Kozloduy nuclear power plant with Westinghouse's AP1000 technology.

The deal follows the selection of Westinghouse as a preferred bidder in

late 2013. Westinghouse says that the AP1000 reactor is scheduled to be on line in 2023 and that construction will involve Bulgarian and global firms.

According to *World Nuclear News* (WNN), the agreement also decides the ownership of project company Kozloduy NPP-New Builds plc, with Kozloduy NPP plc owning 70 per cent and Westinghouse 30 per cent.

Westinghouse will provide all of the plant equipment, design, engineering and fuel for the seventh reactor at the Kozloduy site. It says it will not remain as an equity investor once the project has started operating, and that progress

to the construction phase will be dependent on finalising key aspects such as financing, *WNN* reported.

In July Canadian firm SNC-Lavalin said it had signed an agreement with Chinese General Nuclear Power Group (CGNPG) to build two reactors in Romania using Candu technology.

CGNPG in 2013 signed a deal with Romania's Societatea Nationala Nuclearelectrica for the construction of units 3 and 4 at the Cernavoda site, but have yet to complete a commercial agreement on the project.

China's Industrial and Commercial Bank has agreed to provide \$9 billion

of finance for Cernavoda, while SNC Lavalin is working with Export Development Canada for financing of its portion of the deal.

SNC has also signed a memorandum of understanding with China National Nuclear Corp to pursue power generation, mining and nuclear-related environmental projects around the globe.

Earlier this year Westinghouse said that it would supply three AP1000 units to NuGeneration Limited (NuGen) for its proposed Moorside project in northern England.

The Moorside project could start operation in 2024, according to NuGen.

UGC project takes shape in Tanzania

■ Government to invest in Tanesco ■ 10 GW of new capacity targeted

Siân Crampsie

Tanzania's first underground coal gasification (UGC) to power project is taking shape after it signed a memorandum of understanding (MOU) with Australian and US oil and gas companies.

Linc Energy of Australia and Texan oil company Olympic Exploration have outlined a programme of coal exploration and power plant development with Tanzania's National Development Corporation (NDC) that envisages the development of a 400 MW power plant in late 2017.

NDC has agreed to work with the two international firms to obtain all necessary permits and approvals for the project, while also assisting with the

securing of land access, utilities and the development of a long-term power purchase agreement (PPA).

The project would make use of Tanzania's coal resources and would provide a much-needed and timely delivery of power into the Tanzanian electricity grid, said Linc Energy in a statement. It also said that the project would "cement the country as a regional leader in the adoption of clean coal technologies and power generation".

Tanzania has already drawn up plans to revamp its ailing state electricity utility, Tanesco, in order to attract investment to the sector. The Energy and Minerals Ministry said last month that the government would invest at least \$1.2 billion in Tanesco as part of plans

to improve the reliability of power supplies.

The government wants to attract enough investment to diversify power sources and add 10 000 MW to the grid by 2024. It also has ambitions to become a regional energy hub after the discovery of large natural gas reserves.

Tanzania's installed capacity stands at 1600 MW, with only 24 per cent of the population connected to the grid. The reform strategy includes plans to unbundle Tanesco and reach a 75 per cent electrification rate.

Around half of the new capacity additions will be based on natural gas following a flurry of discoveries by exploration companies off Tanzania's southern coast. Proven gas reserves

stand at 47 trillion cubic feet (tcf), up from less than 10 tcf five years ago.

Revisions have also been made to Tanzania's coal reserves, with the Energy and Minerals Minister announcing in 2013 that the country has up to 5 billion t of coal in place, higher than the previous figure of 1.5 billion t.

Mlingi Elisha Mkucha, acting Managing Director, NDC said that the MOU with Linc Energy and Olympic Exploration presented "an excellent opportunity for Tanzania to produce power from resources that would otherwise have not been tapped".

Mkucha added: "Linc Energy's technology will allow power production in the remotest areas of Tanzania, which currently have limited grid connectivity, and thus enhance economic

activities in these areas and contribute significantly towards the reduction of household poverty."

UGC involves converting coal still in the ground into a combustible gas that can be used for industrial heating, power generation, or as a feedstock for other industrial processes. UGC involves drilling two wells into the coal, one for injection of the oxidants and another well some distance away to bring the product gas to the surface. It can be a way of using otherwise unrecoverable coal deposits in a economically viable way.

Lincoln has developed UGC technology that it has demonstrated at its Chinchilla facility in Australia, and since 1999 has developed and operated five gasifiers.

UNEP, DNV collaborate on climate

DNV GL and the United Nations Environment Programme (UNEP) are aiming to accelerate the uptake of climate change mitigation and adaptation technologies in developing countries through a new strategic partnership.

UNEP and DNV have created a partnership that will assist UNEP's Climate Technology Centre and Network (CTCN), which provides technical assistance and fosters collaboration among climate technology stakeholders. The Norwegian government will support the CTCN with NOK60 million in the period 2013-2015.

DNV GL will support CTCN operations by utilising its extensive experience in technology transfer, knowledge management and capacity building.

DNV GL will also facilitate the engagement of the private sector in order to stimulate technology cooperation among developed and developing countries. The Network will create a space for exchange and technical collaboration with developing countries on thematic areas such as agriculture, energy, forestry, industry, and water.

"Replacing current technologies with cleaner, low-carbon alternatives is a vital part of tackling the causes and effects of climate change," said UNEP Executive Director Achim Steiner. "The strategic partnership between CTCN and DNV GL will play a vital role in accelerating the use of new technologies in improving the lives and livelihoods of millions of people in

developing countries who are dealing with the impacts of climate change on a daily basis."



Steiner: low-carbon alternatives are "vital" to tackling climate change

Cape Town connects with 'prosumers'

Residents in the South African city of Cape Town will soon have the option of becoming self-generators with the ability to feed small amounts of surplus energy back into the electricity grid.

A small scale embedded generation (SSEG) tariff is about to be launched in the city as part of a wider initiative by the council to create a sustainable city that by 2020 sources ten per cent of electricity needs from renewables.

A pilot project has already started operating in which a small number of residential, industrial and commercial consumers have connected rooftop photovoltaic (PV) systems to the grid, making them 'prosumers' - consumers who also produce.

"Most SSEG projects generate electricity from renewable sources like the sun and wind," said the city's

Executive Mayor, Patricia de Lille. "South Africa is blessed with sunshine and the city is embracing SSEG technology to assist with the country's acute power supply.

"By doing so, we are assisting businesses and households to minimise their own electricity consumption from the grid."

The city council has been investigating solutions that will allow consumers to feed power back into the electricity grid and receive credits on their electricity accounts for doing so. It says that residents will have to pay themselves for the installation of a bi-directional advanced meter infrastructure (AMI) credit meter, and that the Electricity Services Department is finalising the outstanding items that will enable the programme to go ahead.

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Egypt battles power outages

- 3960 MW plant proposed
- Nuclear project revived

Egypt's government has pledged to add 4810 MW of generating capacity to the country's power grid by November in a bid to overcome severe power shortages.

Prime Minister Ibrahim Mehlab said last month that fuel shortages, hot weather and poor maintenance had resulted in capacity shortfalls necessitating the use of rolling blackouts across the country on a daily basis.

Some of the outages have also been blamed on attacks on electrical lines by saboteurs who support ousted President Mohammed Morsi. Electricity Minister Mohammed Shaker has vowed to bring an end to all power outages in four years.

Emirati investor Hussein Jasim Al Nowais has proposed the construction of a 3960 MW power plant in three stages in Oyun Musa at a cost of \$7.5 billion.

In addition, state-owned newspaper *Al-Ahram* reported in July that Egypt would launch a tender at the end of the year to build its first nuclear power plant.

The plant would be located at Dabaa on Egypt's Mediterranean coast and would comprise two units generating 2500 MW. Russia's Rosatom is reported to be in talks with the Egyptian government over the Dabaa plant, which was started by former president Hosni Mubarak.



Prime Minister Ibrahim Mehlab

Profits fall at E.On and RWE

■ E.On's non-EU earnings fall ■ RWE plans further capacity closures

Germany's utilities continue to suffer financially from the country's rapid transition to renewable energy.

RWE reported a 62 per cent fall in profits when it announced its second-quarter results last month, while E.On posted a 20 per cent fall in profits for the first half of this year.

Both firms blame Germany's renewable energy expansion, which has squeezed wholesale power prices, for their financial difficulties. RWE said that many of its power stations were unable to cover their operating costs and that it would shut more power plants.

E.On, Germany's largest utility by market value, reported that its underlying net income for the first half of 2014 was €1.5 billion, compared with €1.9 billion for the same period in 2013. It has maintained its earning forecasts for the full-year.

RWE's recurrent net income, the measure used to calculate dividend, dropped from €1988 billion in the

first half last year to €749 billion in the first six months of 2014.

RWE said it would decommission a further 1000 MW of generating capacity by 2017, and terminate supply contracts for about 500 MW of capacity. CEO Peter Terium said that the firm has "had to stomach substantial earnings shortfalls".

RWE has around 40 000 MW of generating capacity at 50 sites across Europe. E.On announced in March that it would close 13 000 MW of capacity, or more than a quarter of its entire conventional fleet in Europe.

Both E.On and RWE have pursued aggressive cost-cutting strategies to cut debt and improve their balance sheets in the challenging environment, while E.On has also looked for growth opportunities outside Europe. Both companies have lobbied Germany's government to follow the UK's example and introduce a capacity market.

E.On says that earnings from its fos-

sil fuel power generation businesses in Italy and Spain rose in the first half of the year, while earnings before interest, tax, depreciation and amortisation (Ebitda) from renewables rose by seven per cent to €870 million. The firm has invested €9.5 billion in renewables since 2007.

In addition E.On said that its domestic retail business in Germany had performed well. "I'm particularly pleased that in the second quarter we again added new residential customers," said Johannes Teysen, E.On's CEO. "In the first half of the year E.On gained a new customer every eight minutes on a net basis."

He added: "Our half-year earnings were in line with our forecast and –considering the difficult situation. So on balance E.On performed rather well in a difficult environment."

Outside Europe, E.On's Ebitda fell by 26 per cent, or €81 million. Ebitda at E.On's Russia unit was 24 per cent below the prior-year level.

Dynegy doubles generating portfolio

Duke Energy seals its exit from the merchant power business with a \$2.8 billion deal with Dynegy.

| Siân Crampsie

US power firm Dynegy says it will transform its power generation fleet with two deals to buy 12 500 MW of coal and gas generation from Duke Energy and Energy Capital Partners (ECP).

Dynegy will pay a total of \$6.25 billion for the power plants, doubling its generating capacity to 26 000 MW and giving it retail operations in three new states. It said that the ECP assets and Duke generation portfolio would complement its existing business by adding scale and fuel diversification, particularly in the PJM Interconnection and New England markets.

Of the 12 500 MW being acquired, 5053 MW are modern combined cycle natural gas plants and 3793 MW are environmentally compliant coal generation plants. "The addition of these portfolios is forecasted to significantly improve our financial outlook by tripling our 2015 adjusted Ebitda and being massively accretive to adjusted Ebitda and free cash flow per share in 2015 and beyond," said Dynegy CEO Robert Flexon.

Duke said that the agreement with Dynegy was an important milestone in its strategy to exit the merchant power business. It will receive \$2.8 billion in cash from Dynegy for the 11 merchant power plants and Duke Energy Retail Sales.

Separately Duke said it had signed an agreement to purchase the generating capacity of Electricities, which manages the retail operations and power generating assets of the North Carolina Eastern Municipal Power Agency.

The \$1.2 billion deal will add 700 MW to Duke's portfolio and will help to reduce power bills for residents in North Carolina, according to Duke.

Businesses and residents in the communities served by Electricities have long been paying hundreds of dollars more a year for electricity to help service massive debt owed by the power agency, which decades ago bought shares in the Shearon Harris Nuclear Plant near Raleigh and three other facilities.

By selling its shares of the plants back to Duke-Progress, Electricities can eliminate 70 per cent of its \$1.9 billion in outstanding debt.

Colombia power firm buys up GDF assets



■ GDF reduces debt ■ Belgian reactor closures prolonged

GDF Suez says that the sale of assets in Panama and Costa Rica will reduce debt and enable it to invest in fast growing markets.

The European utility has sealed a deal with Colombian firm Celsia to sell the 188 MW Dos Mares hydropower complex, the 83 MW Cativa fuel oil plant and the 50 MW Guanacaste wind farm, all of which it wholly owns.

Also included in the deal is GDF Suez's 51 per cent share in the 249 MW Bahia Las Minas thermal power complex.

GDF Suez said in a statement that its net debt would fall by \$1 billion as a

result of the sale, which was finalised through direct negotiations with Celsia. It also said that proceeds from the transaction would "be redeployed to consolidate current strongholds and materialise new opportunities in fast-growing countries."

Growing its business outside of Europe is a key part of GDF Suez's business strategy. In July, the firm announced that the shutdown of two nuclear reactors in Belgium would last for longer than expected and would hit its profits in the second half of the year.

The delay is a blow to GDF Suez's

European power business. The utility said that profits would be hit in the second half by €40 million for each month the Doel 3 and Tihange 2 reactors are closed.

The two nuclear reactors were shut down in late March by the Belgian authorities following tests on the reactors' pressure vessels that showed "unexpected results" regarding their resistance. Both reactors had already been shut in 2012 after micro-cracks were found on their pressure vessels.

GDF Suez had hoped to restart the reactors in July but says that additional tests are required.

Gamesa on track for strong 2014

A recovery in global demand for wind turbines has helped Gamesa to double its net profit and strengthen revenue growth in the first half of 2014.

The Spanish wind turbine company ended the first half of 2014 with €42 million in net profit – almost twice the figure for the same period of 2013 – and an increase in revenues of 13 per cent to €1262 million.

Gamesa, which has positioned itself for a move into the offshore wind market, says the results are at the high end of its guidance for 2014 and are the result of growth in sales of wind turbines and services. It also reported a €71 million reduction in debt over the last 12 months, marking progress towards its balance sheet target.

Gamesa reported that wind turbine sales rose 25 per cent over the first half of 2013 to 1187 MWe and that it is on track to reach the high end of its sales guidance for 2014 of 2400 MWe. The USA accounted for 20 per

cent of revenues, while emerging markets such as India and Latin America accounted for 30 and 36 per cent, respectively.

Europe and the rest of the world accounted for 13 per cent of sales, with prospects for an increase in their share in the second half of the year.

Gamesa is hoping that the offshore wind energy sector will provide it with "complementary" growth opportunities. Offshore wind installations are expected to account for one-third of the total in Europe in the next five years, with global installations reaching 45 GW by 2020.

■ Wind turbine firm Nordex reported a 23 per cent increase in sales to €815 million in the first half of 2014. The firm says that the results were driven by stable operations in the EMEA region and growth in new markets in Latin America and Asia. Globally, new installed capacity climbed by around 19 per cent to 667.3 MW.



10 | Tenders, Bids & Contracts

Americas

Energy storage system for Kauai Island

Saft has been awarded a multi-million dollar contract by Kauai Island Utility Co-operative (KIUC) to provide a Li-ion battery energy storage system (BESS) as part of a new 12 MW solar energy park under construction in Anahola.

Saft's BESS will help mitigate issues caused by fluctuations that can occur with intermittent renewable power sources. As part of the agreement, Saft will provide 6 MW/4.63 MWh BESS consisting of 8 Intensium Max 20 M containers and two containers housing an ABB 6 MW PCS to stabilise the electrical grid.

The system will also regulate the distribution bus voltage, serve as spinning reserve and provide frequency support during the loss of generation by pooling and integrating with other distributed KIUC BESS sources.

REC, Sunrun sign agreement

Solar firm Sunrun has signed an agreement with REC Group to buy between 50 and 100 MW of REC's Peak Energy Series solar panels in 2015.

The deal is a key part of REC's plans to increase its business in the USA, where Sunrun is the largest dedicated residential solar company.

This latest contract follows Norway-based REC's announcement of its 72-cell utility-scale panel product for the US market and other supply agreements, which have contributed to REC doubling its US order intake over the past 12 months.

Iberdrola awards Mexico HRSG

Iberdrola has awarded Foster Wheeler a contract to design and supply a heat recovery steam generator (HRSG) for a new cogeneration plant planned for the Kimberly Clark de Mexico Ramos Arizpe Facility in Coahuila, Mexico.

Foster Wheeler will design and supply the HRSG and provide advisory services for erection and start-up of the unit. The HRSG will incorporate a dual pressure level design with the capability to produce steam with or without combustion turbine operation. The HRSG will be coupled to a GE LM6000PH combustion gas turbine.

Commercial operation of the HRSG is scheduled to begin during the first quarter of 2016.

IMG Midstream orders Jenbacher engine

GE's Distributed Power business is to provide Jenbacher gas engine technology to IMG Midstream for two 20 MW power projects in Pennsylvania, USA.

The two projects will serve the PJM Interconnection region with energy as well as capacity and ancillary services. GE will provide ten of its Jenbacher J624 two-stage turbocharged gas engines for the projects.

Capstone boosts orders

Capstone Microturbine Corporation has received orders for 25 of its C65 microturbines, totalling 1.6 MW of capacity, for use in various commercial industrial combined heat and power (CHP) and oil and gas applications in the Mid-Atlantic USA.

A number of the C65s will be deployed in CHP and CCHP (combined cooling, heat and power) applications in the Mid-Atlantic territory for use at a university and

in multi-family housing complexes. The remaining portion of the 25-unit order was sold into midstream operations throughout the Marcellus and Utica shale formations.

Asia-Pacific

ABB supports Himalayan hydro

ABB is to provide the electrical balance of plant for the Dikchu hydroelectric power plant in East Sikkim, India.

ABB will connect the 96 MW power plant to the main national grid by designing and engineering the complete electrical system. The scope also includes supply of a variety of electrical products, such as 132 kV GIS, MV and LV switchgear, transformers, cabling, fire fighting, protection, HVAC, earthing, busduct, DC system, illumination and alarm systems.

The Dikchu plant will be built completely underground in Sikkim in the eastern Himalayas.

Voith modernises in Himalayas

Voith has received two new orders to supply the equipment for two hydropower projects in the Himalayas.

The company is to supply equipment and services for the modernisation of the Salal hydro plant on the river Chenab in northern India, and will also provide the complete electromechanical equipment for three generating units at the Rasuwaghadhi hydropower plant in Nepal.

The two projects have a total order volume of more than €23 million and will both be carried out by Voith Hydro in India.

Sumitomo secures Ulubelu geothermal contract

Japanese trading house Sumitomo has won an engineering, procurement and construction (EPC) contract for Pertamina's Ulubelu geothermal power plant project in Lampung, Indonesia.

The 110 MW plant will be constructed by Sumitomo together with the company's local partner, state-owned engineering firm Rekayasa Industri. It will comprise two separate units and form part of the largest geothermal plant complex in the area.

"Construction of [unit 3 and unit 4] should be completed by July 2016 and July 2017 [respectively]," the company said in a statement.

The complex already comprises two geothermal plants with a combined capacity of 110 MW.

Pertamina secured \$300 million in loans from the World Bank in 2012 to finance several geothermal projects, including Ulubelu.

Mitsubishi and Daewoo order HRSGs

Foster Wheeler has been awarded two contracts for heat recovery steam generators (HRSGs) through Asian licensee, BHI.

Mitsubishi Corp has awarded BHI a contract for the design and supply of four HRSGs for the 240 MW Bangpoo cogeneration plant in Thailand, while Daewoo Engineering & Construction has placed an order for two HRSGs for the Pocheon 940 MW CCGT project in South Korea.

Bangpoo is expected to start operating in late 2016, while Pocheon will be commissioned in early 2017.

Europe

Nordex to build Orla wind farm

C&C Wind has awarded Nordex a contract to deliver and install nine

turbines from its N100/2500 series at the Orla wind farm project in Poland.

The contract marks the first phase of construction of the project, which will eventually comprise 15 N100/2500 wind turbines as cold climate version. The first wind turbines to be installed will enter operation in December 2014.

Siemens wins offshore wind orders

Norwegian energy firms Statoil and Statkraft have awarded two contracts to Siemens Energy for the engineering, supply, assembly, commissioning and service of 67 D6 direct-drive wind turbines for the UK's Dudgeon offshore wind farm.

Siemens will supply its 6 MW SWT-6.0-154 wind turbine unit to the project, with turbine delivery and installation starting in early 2017. It has also been awarded a service contract covering operation and maintenance of the turbines for five years.

Siemens has also been awarded an order for 72 Model SWT-4.0-130 wind turbines for Vattenfall's Sandbank offshore wind farm in Germany. Vattenfall also contracted Siemens to perform maintenance services on the Sandbank installations for an initial period of five years.

The €90 million cabling contract for the project has been awarded to VSMC.

Voith to modernise Waldeck

Voith has announced it is to modernise a generator at Waldeck 2, one of the most important pumped storage hydropower plants in Germany.

Under a contract awarded by E.ON Kraftwerke GmbH, Voith will replace, assemble and commission the stator and rotor of machine six at Waldeck 2 in North Hesse.

The project will extend the life as well as increase the efficiency of the machine unit.

The contract is valued at around €9 million and includes an option to modernise a further machine unit at the plant for an additional €5 million.

KPA Unicon to provide biomass plant

Imatran Lämpö Oy and KPA Unicon have signed a €10 million contract to deliver a biomass-fired heating plant to Virasjoki in Imatra, Finland.

KPA Unicon's turnkey delivery includes all process equipment, buildings, installation work, commissioning and training of personnel, excluding foundation work. The plant will have an output of 30 MWth (2 x 15 MWth) and will produce hot water for the district heating network.

The heating plant will be fuelled by locally sourced wood-based biomass and can also use peat as fuel.

Atkins appointed for tidal lagoon

Tidal Lagoon Swansea Bay plc has appointed Atkins to act as an engineer for its proposed 320 MW tidal lagoon project in the UK.

Under the contract, Atkins will provide specialist design and engineering support, including producing outline designs for the breakwater, turbine house and ancillary works and supporting the tender process by helping develop documents and reviewing responses and detailed designs.

Once construction work starts in Spring 2015, Atkins will also provide a range of site supervision, auditing and technical checking services.

Nordsee One inter-array cable package

JDR has signed a contract with Siem Offshore Contractors GmbH for the Nordsee One offshore wind farm currently being developed by RWE Inogy GmbH and forming part of Germany's largest offshore wind farm cluster.

JDR will provide over 70 km of aluminium core inter-array cable, cable accessories and post-km offshore services. Alongside the inter-array cables, JDR will supply a range of accessories including cable pulling grips and hang-offs, cable cleats, power core termination connectors and fibre optic splice boxes.

ABB to provide MeyGen connection

ABB has been awarded a contract by Atlantis Resources Limited to provide the onshore grid connection for Phase I of the MeyGen tidal stream project in Scotland's Pentland Firth. MeyGen is the UK's first large-scale tidal array scheme.

ABB's project scope includes design, engineering, supply and commissioning of the power conversion, switchgear and transformer solution as well as associated civil engineering and cabling works. Major product supplies include transformers, medium voltage switchgear and power converters.

International

Senegal to add 53 MW

ContourGlobal has signed an agreement with Senegal national utility Societe Nationale d'Electricite du Senegal (Senelec) to build a new 53 MW thermal power plant.

ContourGlobal, an international power generation company, has signed a 20-year power purchase agreement with Senelec for the sale of energy from the new facility, which will be able to burn heavy fuel oil and natural gas. The firm has also agreed to rehabilitate an existing brownfield site.

The new power plant will be completed in 2015. It will be equipped with Wärtsilä 18V46 engines.

Kenya to boost geothermal energy generation

Kenya has invited bids for the construction of two new geothermal power plants as part of the country's plan to boost electricity production by 5000 MW in three years.

The new plants will have a total combined capacity of 60 MW and form part of Kenya's plans to tap its geothermal energy potential of 10 000 MW.

SEC launches Duba 1 tender

Saudi Electricity Co. (SEC) has launched a tender for its 550 MW Duba 1 project, the Kingdom's first integrated solar and combined cycle gas power plant.

The \$600 million plant is expected to come on-stream in 2017. SEC has set October 15 as the deadline for receiving bids.

Hyundai E&C lands \$248 million substation project

Hyundai Engineering & Construction has won an order worth \$248 million in Saudi Arabia.

The state-run Saudi Electricity Company (SEC) awarded a contract to build a 380 kV substation and repair existing substations in an industrial zone in Jubail. The construction project will be completed in October 2016 after 27 months of work.



Oil

Market rests easy amid ample crude supply

- US domestic oil production continues to gain
- Opec unlikely to cut production

David Gregory

Crude oil prices touched \$100/b in mid-August and some benchmarks moved into the \$90/b range for the first time this year. West Texas Intermediate has been in the \$90/b range since end-July and the Opec Basket went below \$100/b on August 15.

Under normal circumstances world oil markets would react differently to the many geopolitical crises and register price increases. But the opposite is true in light of sufficient supply and some analysts forecast that prices could continue to fall further into the autumn.

Despite civil wars in Libya, Syria and South Sudan, a widening insurrection that threatens the future of Iraq, and deteriorating relations between the European Union and Russia over Ukraine that could impact the volume of energy sales between EU countries and Moscow, the market has adhered more to market fundamentals in recent weeks.

The \$100/b mark is usually the red line for Opec, which has stated on

numerous occasions that this is a fair price for crude oil. But it looks unlikely that the group will act to cut production and thus increase crude prices as Libya looks ready to return to the oil market and Iran continues to seek ways to circumvent international sanctions and sell more of its oil.

Meanwhile, US domestic oil production continues to gain and is contributing to fundamentals that show the global market as well supplied. Furthermore demand is falling due to the more efficient use of energy, Europe's sluggish economy and a decline in demand in China.

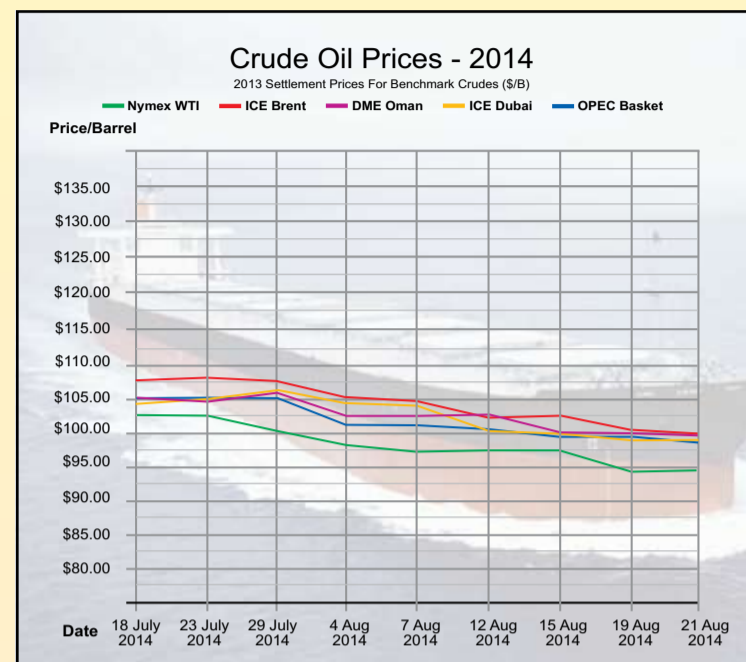
Commenting on the decrease in oil prices from June to mid-August, the International Energy Agency said in its August *Oil Market Report* that the price weakness is demand driven. "Global demand in 2Q14 grew at the lowest pace since 1Q12, latest data reveal. At the same time, ominous as the current gathering of geopolitical clouds may be, the potential supply impact from these developments is not as straightforward as it might appear."

The report notes there is an oil glut in

the Atlantic Basin, "where surprisingly steep demand contraction recently compounded the effect of relentless North American supply growth". The agency said low oil deliveries in the US and Europe caused it to estimate global demand growth for 2Q14 to less than 700 000 b/d year-on-year – a low of more than two years – and by 180 000 b/d for 2014 as a whole. It estimated that demand in the US and Europe fell by 440 000 b/d combined for the last quarter.

While Libya continues to suffer the effects of civil war, the country's National Oil Corporation (NOC) is attempting to regain control of infrastructure and export terminals. Recent media reports say the 340 000 b/d Es Sider terminal is about to begin operation and that export capacity could soon return to more than 500 000 b/d – still less than half of the 1.2 million b/d Libya was exporting in early 2013.

However, the IEA questions whether Libya will be able to find a market for its crude. "The Atlantic market is currently so well supplied that incremental Libyan barrels are reportedly having a



hard time finding buyers. Many in the market seem more focused today on potential short-term downward price pressures from a further increase in Libyan production, last pegged around 450 000 b/d, than on such upward price pressures as might result from an escalation of fighting."

The IEA added that US and EU sanctions on the Russia oil sector are not providing support for the oil markets either. It said the consensus in the industry is that sanctions against Russia will not have any tangible near-term impact on supplies.

While violence appears to be escalating in Iraq, crude production in the southern areas of the country remain unaffected so far by the onslaught of the Islamic State militant group. The group has captured some oil fields and

infrastructure in northern Iraq and some operations in Iraqi Kurdistan have been curtailed.

Baghdad has been preparing to expand its infrastructure in order to boost production, which is now around 3.2 million b/d, but the advance of Islamic State fighters into north, central and western Iraq is expected to force delays in some projects.

Should circumstances develop that jeopardize global supplies, the IEA expressed confidence that Opec would step up to the challenge: "While the situation across these key producer countries remains more at risk than ever, so far the market appears confident that Opec can deliver the production increase needed from it to meet rising demand expected in the second half of the year."

Gas

Russia-Ukraine in critical talks over gas dispute

As the gas dispute continues between Moscow and Kiev, a meeting between Russia, Ukraine and EU officials is likely to be crucial for all involved. In the most recent episode of the row, Russia claims Ukraine owes it \$5.3 billion for gas delivered since November 2013.

Mark Goetz

In late August, the presidents of Russia and Ukraine and several top officials from the European Commission were days away from meeting in Belarus for the purpose of solving the long-running dispute over natural gas supply, trans-shipments and payments between Moscow and Kiev.

As fighting in eastern Ukraine continues between the Ukraine army and pro-Russian forces, the meeting is likely to be crucial for all involved.

The EU has imposed sanctions against Russia for annexing Crimea and its support for the pro-Russian separatists. Brussels is also concerned that the worsening of relations between the two countries could impact its own energy security – as it has on two occasions in the past. About half of Russia's gas supplied to the EU transits Ukraine.

Several important Russian gas pipelines run through eastern Ukraine, including the one that feeds gas to the

Blue Stream pipeline, which runs across the Black Sea to Turkey. Control of all the pipelines through which its gas is transported is an important issue for Gazprom, which has sought to acquire ownership of the strategic pipeline network that stretches across Ukraine, once part of the Soviet Union's pipeline network.

In the most recent episode of the row, Russia claims Ukraine owes it \$5.3 billion for gas delivered since November 2013. Russian gas monopoly Gazprom halted deliveries to Ukraine in mid-June when Kiev refused to pay the bill. Furthermore the two countries – through their respective state companies Gazprom and Nathogaz Ukrainy – have disagreed over payments Russia has made to Ukraine as transit fees for Russian gas to Europe.

Kiev argues that Moscow is charging unfair prices and seeks a reduction that reflects offers Moscow made before the revolution. The price that Gazprom charged Ukraine during the

second quarter of this year was \$485.50 per 1000 m³, compared with \$268.50 per 1000 m³ in the first quarter. Price talks stalled in early June when Russia refused to sell gas for less than \$385/1000 m³ and Kiev refused to pay more than \$326/1000 m³.

Russia halted shipments to Ukraine as a result but shipments to Moscow's European customers are reported to be continuing unaffected. Ukraine is now considering its own set of sanctions to impose against Russia.

The outcome of the meeting in Belarus between presidents Vladimir Putin and Petro Poroshenko, EU Energy Commissioner Günter Oettinger, EU Foreign Policy Commission Catherine Ashton and EU Trade Commissioner Karel DE Gucht will likely set the course for future Russian gas shipments through Ukraine and determine whether Ukraine will itself be a future customer for Russian gas.

Europe is keen to resolve the Ukraine crisis, as a worsening of the circumstances will likely lead to gas shortages

for Ukraine during the approaching winter and risks an interruption of supply to EU members, many of which rely heavily on Russian supplies.

Kiev, in the meantime, is preparing for a winter without Russian supply. Prime Minister Arseniy Yatseniuk said last month that Ukraine needs a further 5 billion cubic meters (bcm) of Russian gas and would probably need to import coal as the country's mines are not able to provide sufficient amounts due to the fighting in eastern Ukraine.

Ukraine used 50 bcm of gas last year and has only 15 bcm in storage Yatseniuk said, adding that Naftogaz Ukrainiy had set aside some \$3 billion for gas purchases for the winter period and was looking to buy gas from the EU.

Meanwhile, Russia has trouble with its proposed South Stream gas pipeline project, which is designed to bypass Ukraine by transporting gas across the Black Sea through a 900 km subsea pipeline to Bulgaria and

southeast Europe.

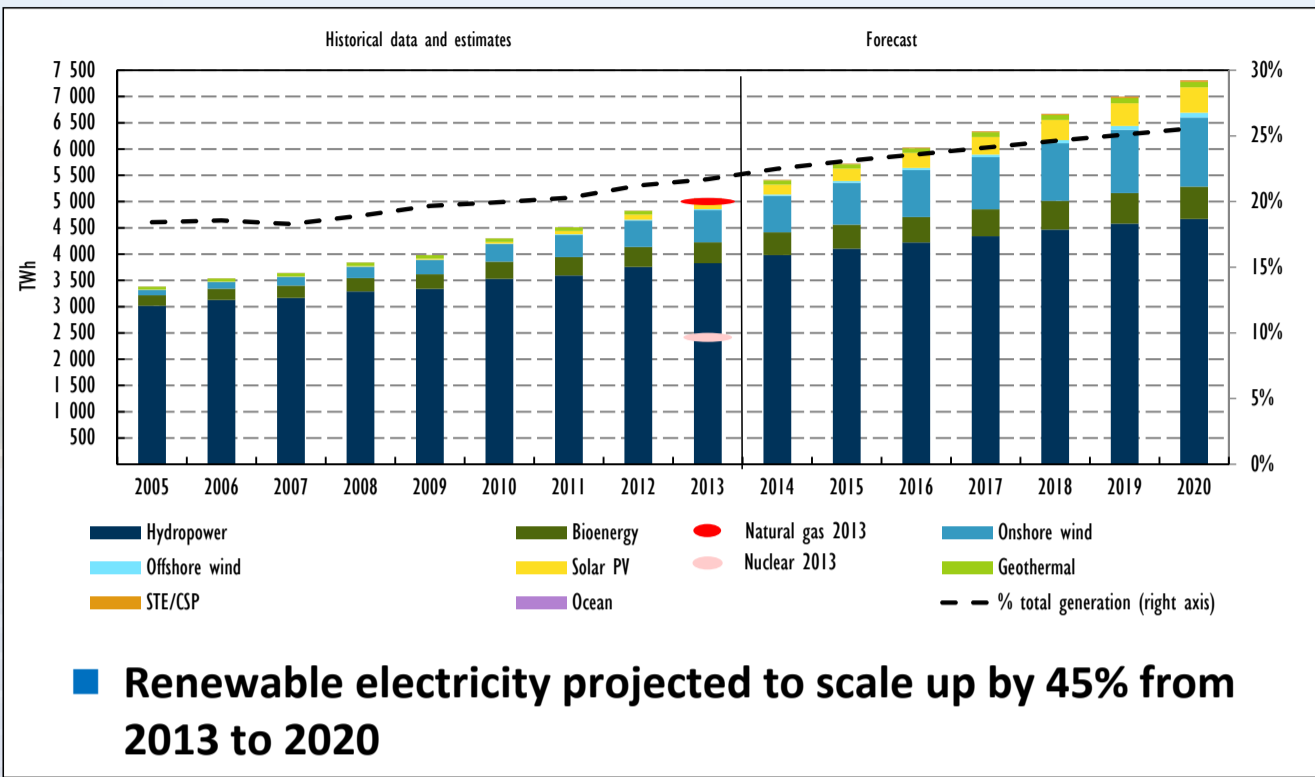
While there have been doubts about the project since it was first proposed by Putin in 2007, South Stream is now encountering opposition from the European Commission that has solidified since the start of the Ukraine crisis.

The EU is insisting that Russia allows third party access to the pipeline, part of its Third Energy Package, which does not allow a company such as Gazprom to own the pipeline and supply the gas that is transported through it.

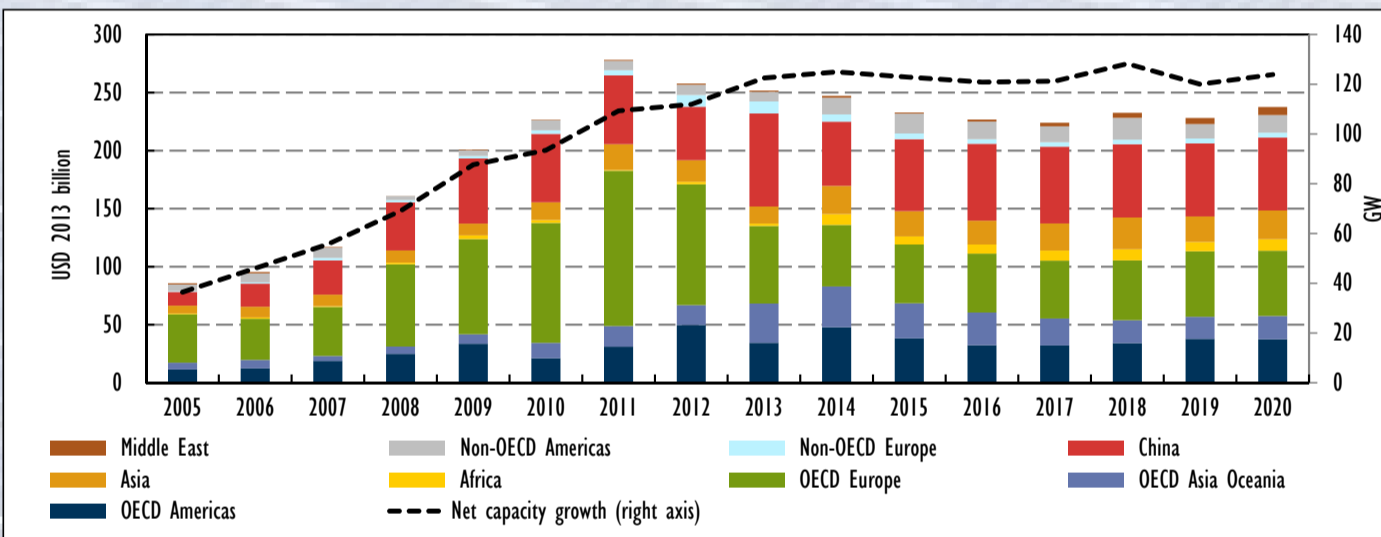
The EU has suspended talks designed to bring the project in line with EU laws, and construction work that began recently in Bulgaria has been stopped while the EU investigates Sofia's procedure for awarding contracts.

There are questions about whether Gazprom actually needs the extra capacity to ship gas to Europe, when a network in Ukraine already exists. Blocking South Stream will likely press Moscow to try harder towards finding a solution with Ukraine.

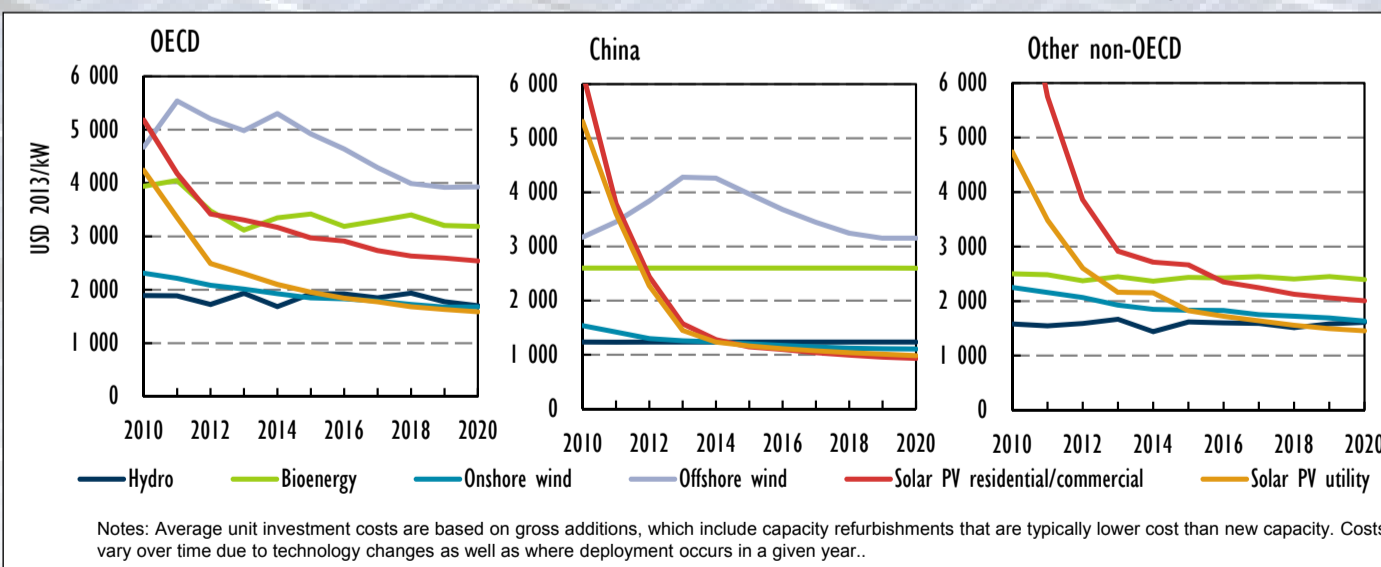
Global renewable electricity production, historical and projected



Investment in new renewable power capacity



Weighted average annual renewable investment costs, historical and projected



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Digesting government policies

Anaerobic digestion has much to offer in terms of waste disposal and energy production but aligning government policies is critical for sustained growth.

Junior Isles

Anaerobic digestion (AD) can be an attractive method of recycling organic waste to produce energy or biogas for injection into gas grids. Germany, for example, has been a major success story, while the UK's nascent market has seen tremendous growth in recent years. Yet AD is a technology that remains highly dependent on subsidies – the steady withdrawal of which is posing a serious threat to the industry.

According to a recent report published by the UK's Anaerobic Digestion and Biogas Association (ADBA), the UK's AD market has seen extremely strong growth in the last four years – currently standing at 154 MW electrical equivalent capacity (between electricity and biomethane) from an estimated 145 plants.

The increase in capacity each year since 2010 has been in the range of 26-32 MWe-equivalent (across 20-30 new plants each year). At the same time, ADBA says that the capacity, in terms of the amount of organic waste the industry can treat, has doubled since 2010.

Matt Hindle, Policy Manager at ADBA noted the AD market is still predominantly driven by electricity production.

"The vast majority of new plants have been electricity plants. Over 100 plants are now claiming the electricity feed-in tariff and many are still on the Renewable Obligation Certificates scheme. But we are also just starting to see the first few biomethane to grid plants come through and there will be 15-20 of these in the next year," he said.

According to Hindle there is significant potential for continued growth with "a lot of interest", especially from key sectors like agriculture. Currently, around half of the operating plants are on farms. Another sector that is growing quite fast, in terms of interest level, is industrial waste where a growing number of breweries, distilleries and food factories are installing projects. These help cut waste management costs by disposing of liquid waste while at the same time generating power and heat to meet onsite energy needs.

Yet although this strong growth looks set to continue in the near term, the market is not without its challenges. According to Hindle's estimates, there are about 250 MWe equivalent of potential plant in the system already with planning permission but the realisation of this largely depends on government policy.

"There are some big decisions to be taken, particularly by the next government," said Hindle. "First of all the comprehensive review of the feed-in tariff in 2015 and secondly, the Spending Review, which will dictate the Renewable Heat Incentive (RHI) budget – this determines the support for both biogas to heat and biomethane to grid. The speed of industry growth will depend on how supportive the next government is."

He added: "Once a plant has planning permission and you can make the business plan stack-up, you can typically build-out those plants in one or two years. So potentially we could have fairly quick growth."

It is unlikely the UK will ever reach the dizzying heights of the German market where more than 8000 plants are in operation. This sustained growth over a 10-year period is the result of stable long-term support. The importance of long-term favourable policy for the AD industry cannot be stressed enough.

Even a market such as Germany can falter as a result of changing policy. According to Claudius da Costa Gomez, CEO of the German Biogas Association changes in the new Renewable Energy Law (EEG) leaves the biogas industry in a "very serious" situation. A recent study conducted by the Fraunhofer IWES forecasts that not more than 100 new plants with an installed capacity of under 40 MW are expected to be built in 2014.

Sweden has been particularly strong on the use of biomethane in transport, with about 145 000 gas vehicles.

Although electricity production is still the main driver behind AD, the gas use aspect could become increasingly important. As Hindle points out: "Injection into the gas grid is a

very good use of biogas; it showcases the ability of biogas to make a contribution to decarbonising difficult areas like the gas grid and heavy goods vehicles."

Certainly in the transport sector, in particular, there are huge air quality benefits. Gas vehicles are much more environmentally friendly than diesel vehicles and mixing biogas with natural gas could further reduce the overall carbon footprint.

"We think it's an excellent market to support for helping the UK achieve its targets on renewable heat and transport. The budget for the current support mechanism ends in April 2016, so we will be looking for the next government to ensure there is sufficient support from 2016 through to 2020 to maintain the momentum."

Agraferm, a builder of AD plants in Germany, has already developed 10 biogas and biomethane plants in Great Britain. The company built the first agriculturally based biomethane plant in Britain to feed gas into the national grid.

Markus Ott, Head of Sales, at Agraferm Technologies AG said: "In order to encourage the increased implementation of biogas technology and to create efficient alternatives for the utilisation of organic waste, further systematic political steps are needed to ensure the long term continuity of the business. We would welcome it if these steps became an 'AD master plan' to work together with the industry itself and companies beyond the 2015 elections to ensure continuity and to create the opportunity for advanced planning."

The importance of government planning and support has been demonstrated in the US. Since the start of the Obama Administration, the Rural Energy for America Program (REAP) has supported more than 8200 renewable energy and energy efficiency projects across the nation. During this period, the US Department of Agriculture (USDA) has provided more than \$264 million in grants and \$212 million in loan guarantees to agricultural producers and rural small business owners.

At the start of August the USDA published its Biogas Opportunities Roadmap, which estimates there are currently approximately 2000 sites in the US producing biogas. It says that with proper support, more than 11 000 additional biogas systems could be deployed in the US.

Commenting on the global landscape for AD, Hindle noted: "We see technology development and costs coming down in countries where there is government support."

"For individual developers, in many cases, the opportunity to integrate crops for AD into their farming rotation and improve their farming practice can be the motivating factor. There are other examples where farms might want a renewable source of fertiliser and the digestate produced from an AD plant alongside the energy produced could be the driver."

The UK market is producing some specialisms in terms of technology. For example, whereas the German market is very agriculture-based, the UK is developing a strong food waste

treatment market. The UK is also developing some innovative smaller scale AD projects that treat slurries and manures on farms to produce electricity and heat. At the same time, researchers and universities are working to optimise the digestion process.

It is hoped that technology optimisation combined with economies of scale as volume increases will ultimately lower project costs. Efficiencies gained from operating and maintaining multiple sites could also have a positive impact.

High capital costs, however, are likely to remain a stumbling block. As the concrete and steel used in constructing the large waste storage tanks account for much of the investment, capital costs have not been plummeting as they have for the solar industry.

Hindle believes, however, that there is a case for wider support than just renewable incentives. "We are not just talking about a pure energy plant; it's a plant that also supports farming and waste treatment."

Support from other mechanisms may certainly be critical if the smaller plant sector is to survive in Britain. The FIT for plants below 250 kW was reduced in April this year to 12.4 p/kWh. For plants of 250-500 kW, the FIT is 11.5 p/kWh and 9.5 p/kWh for plants above 500 kW.

"The tariff for plants below 250 kW is likely to be about 10 p/kWh from April next year," said Hindle. "This is a reduction of about third compared to the 2013/14 price, so it's a very serious reduction. It's a big concern for those in the farming side of the industry. The reduction in subsidies is designed to reflect large deployment and economies of scale but this has not happened at the smaller scale and yet we are facing the highest possible reductions."

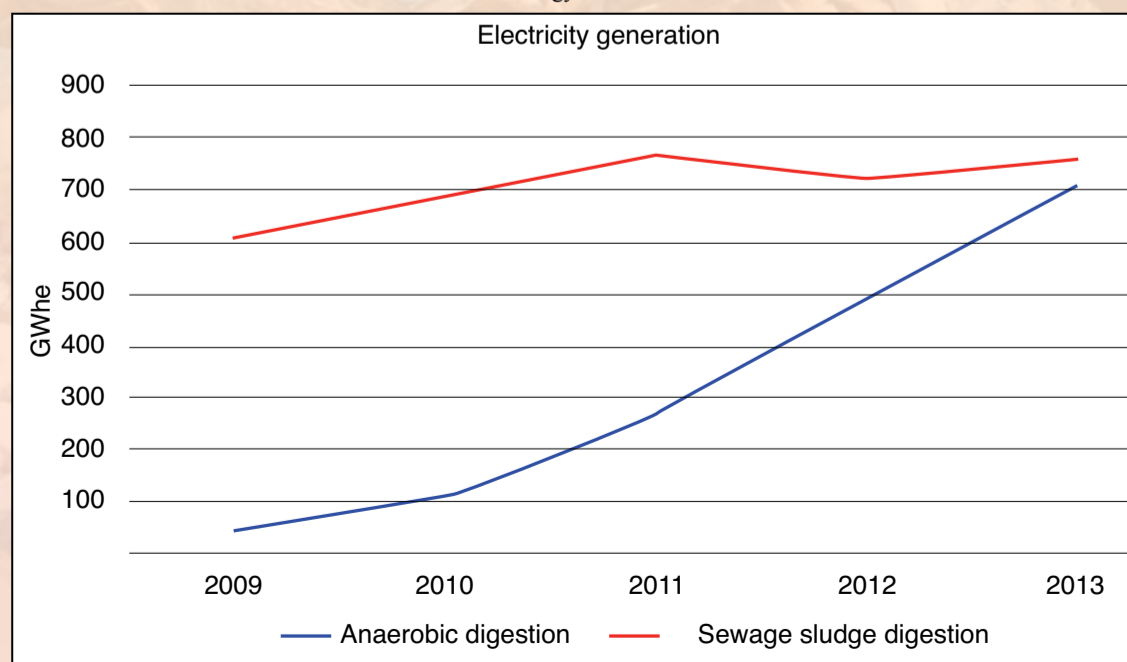
With this part of the market only just starting to get off the ground, the cuts have seriously affected the viability of AD at that scale and Hindle believes there will not be the rollout foreseen at the previous or even the current tariff rate.

ADBA is continuing to discussions with DECC on the level of support that the industry needs, although it is unlikely that there will be any changes before the scheduled 2015 tariff review. At the same time, DECC and Defra (Department for Environment, Food & Rural Affairs) are also investigating whether a broader range of mechanisms can be used to support the industry.

There are lessons to be learnt on food waste policies from across Europe. Even Wales, Scotland and Northern Ireland all have waste policies to ensure organic waste does not end up in landfill. This is having a positive impact on the number of plants.

Hindle concluded: "The [British] industry will not reach its full potential unless waste policy is aligned with energy policy. Almost two thirds of the potential biogas that could be generated comes from food waste, so there has to be a concerted effort to move waste policy up the agenda by, for example, stopping its use in landfill and ensuring households have access to segregated waste."

The increase in UK capacity each year since 2010 has been in the range of 26-32 MWe-equivalent (across 20-30 new plants each year)



Natural gas rising

Despite difficult times in Europe, the global market for gas fired generation looks set for strong growth. **TEI Times** outlines the key findings of a recent analysis undertaken by Frost & Sullivan.

In June this year, the International Energy Agency (IEA) released its 2014 *Medium-Term Gas Market Report*, providing a detailed analysis and five-year projections of global natural gas demand. Notably, it projected a near doubling of Chinese gas demand through 2019, which it said would compensate for a slight slowdown in growth in many other areas of the world.

The IEA's forecasts were corroborated by a recent report by Frost & Sullivan titled: '*Global Gas and Steam Turbine Markets*', which compares the markets for gas and steam turbines. This detailed market report predicts that the rise in natural gas availability will help gas turbines outpace steam turbines in the coming years.

The report attributes the growth to the rising replacement of ageing coal plants with modern gas-fired power

generation.

Frost & Sullivan states that the global gas turbine market is firmly on the upswing. Following a massive drop-off between 2011 and 2012, growth in orders began to return in 2013 and will show steady growth through the end of the decade.

A total of 556 GW of gas turbines is forecast to be ordered over the 2013 to 2020 period. While just over 10 per cent of this will be for mechanical drive applications, power generation will represent the bulk of orders.

The report forecasts that total global orders for gas turbines will rise from 58 364 MW in 2013 to 81 530 MW in 2020. Notably, however, annual orders will not return to 2011 levels until some time during 2018.

Figures reveal that the market will expand significantly, with order

generation.

According to Frost & Sullivan, global gas turbine market revenue is also expected to increase from \$18 billion in 2013 to reach \$26.07 billion by 2020, corresponding to a compound annual growth rate (CAGR) of 5.4 per cent over this period.

Revenues, it says, are increasing as a result of a gradual increase in the cost of gas turbines as capacity utilisation of the leading manufacturers rises. Globally, gas turbine prices are expected to increase. Key factors include rising demand, higher raw material prices, and industry consolidation.

The difficult market conditions that have plagued gas fired generation in Europe in recent years have been well documented. The rapid expansion of renewable energy has created uncertainties regarding the future of carbon markets, which, in turn, has affected the outlook for conventional generation.

In this scenario, gas turbine manufacturers are focusing on the small- and medium-sized gas turbine output ranges to leverage the high demand for flexible generating units. Smaller plants are also faster to build and easier to finance – key considerations in a difficult economic climate.

In the aftermath of the global economic and financial crisis and the ongoing economic weakness in regions such as Europe, project financing remains more difficult than before the crisis, with lenders being much more cautious. This leaves little scope for IPP development in regions such as Europe, where the market for IPP development has virtually collapsed, noted the report.

While utilities are in a better position through their ability to access bond markets, they too are in financial trouble due to low running hours of existing thermal plants. Many of the major utilities, including GDF Suez, RWE and E.ON have all been closing gas fired plant and selling assets to cut debt and protect profits as Europe remains in the doldrums.

There has been growing confidence among the utilities that Europe's electricity sector will turn the corner but this is not expected for another two years. Last year, RWE, Europe's largest utility posted an annual loss for the first time since the Federal Republic of Germany was established.

In late May, RWE's CEO Peter Terium said the German utility was moving through a "vale of tears" that "will last beyond this year and the next", but that the "recovery is going to come". Terium, said that power prices were bottoming out and that they could start to pick up. He also said that Germany's proposed capacity market would benefit the country's traditional utilities.

There seems to be early signs of a turnaround in fortune for gas fired generation as *Platts* unit Bentek Energy reported that UK generators upped their gas use by 38 per cent between July 1-21 this year.

Harald Thaler, Industry Director, Energy and Environment at Frost & Sullivan and lead analyst on the market report commented: "Although the current profitability of gas-fired generation is low in regions such as

Europe, gas turbines will be the technology of choice for future capacity additions."

He added: "Gas turbines will also benefit from increasingly stringent emissions legislation and roll-out of emissions trading schemes in emerging markets, as they curtail the growth of steam turbines."

Frost & Sullivan predicts the EU's position will grow from current low levels but will remain well below historical highs recorded during the early and middle part of the previous decade.

Globally, strong growth is anticipated for the years beyond 2016, as the prospects for new gas plants start to improve in the weak European region and growth accelerates in China and India, driven by the global expansion of gas availability.

At the same time, global natural gas prices are expected to come down from their high levels over the next few years. This is particularly the case in Asia, where contracts are increasingly moving away from oil price indexation towards more flexible contracts linked to spot indices such as the US Henry Hub. Moreover, decreasing LNG transportation costs, once the widening of the Panama Canal is completed in 2015, are expected to significantly reduce gas prices in Asia, thereby increasing its attractiveness.

According to Frost & Sullivan, China and the Middle East led the order books in 2013. Notably, it says that China is expected to takeover from the Middle East as the leading region for gas turbine orders.

Chinese gas turbine orders have expanded dramatically in recent years as the country is expected to increase its gas-fired power generation capacity from 40 GW in 2012 to 91 GW in 2020. The country is looking to tap its shale gas and CBM reserves in addition to growing its pipeline and LNG gas imports.

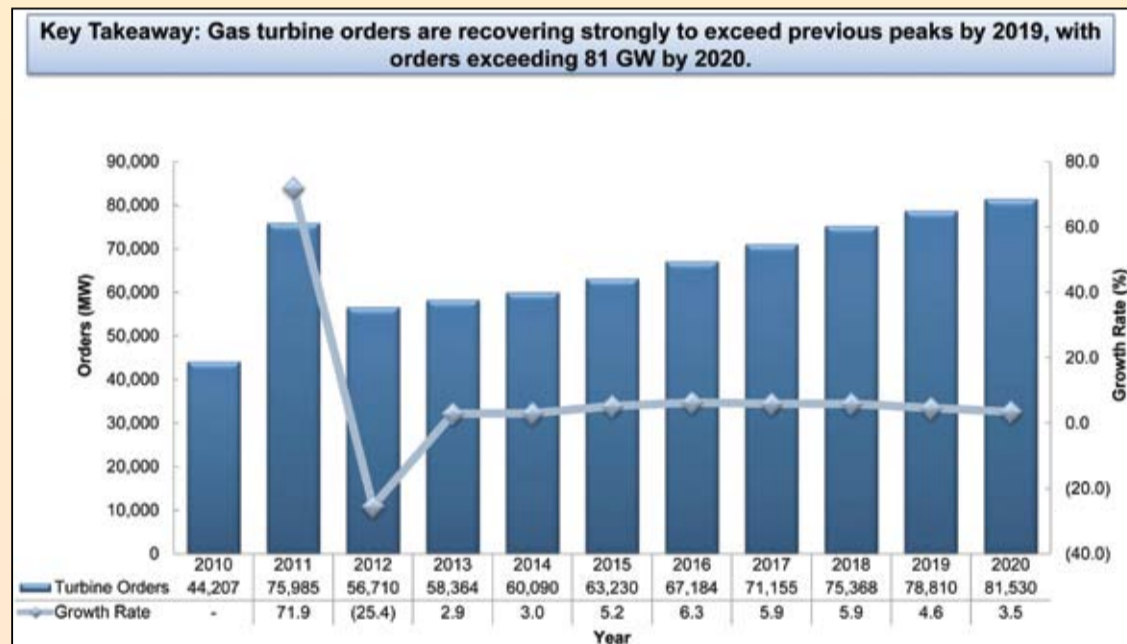
In other parts of Asia the report highlights that orders were driven by Japan and South Korea, with India suffering gas shortages. India will grow strongly but from low current levels as gas shortages improve.

Elsewhere, North America also posted strong orders as relatively cheap shale gas increases the attractiveness of gas turbines. Latin America will also be a hot spot as it orders more gas plants to make the power system less dependent on hydro.

Despite challenging times for gas turbine manufacturers, especially in Europe, the future remains bright. The Frost & Sullivan report concludes: "The gas turbine industry will go from strength to strength due to the replacement of ageing coal plants with modern gas-fired power stations, the growing availability and usage of natural gas in power generation, the strong expansion of the global oil and gas industry, and the rising need for more flexible generating assets."

'Global Gas and Steam Turbine Markets' is part of Frost & Sullivan's *Energy & Power* (<http://www.energy.frost.com>) *Growth Partnership Service* program. For more information on this study, email Chiara Carella, Corporate Communications, at: chiara.carella@frost.com.

Gas turbine market: Orders forecast, global, 2010–2020 CAGR (2013–2020) = 4.9 per cent

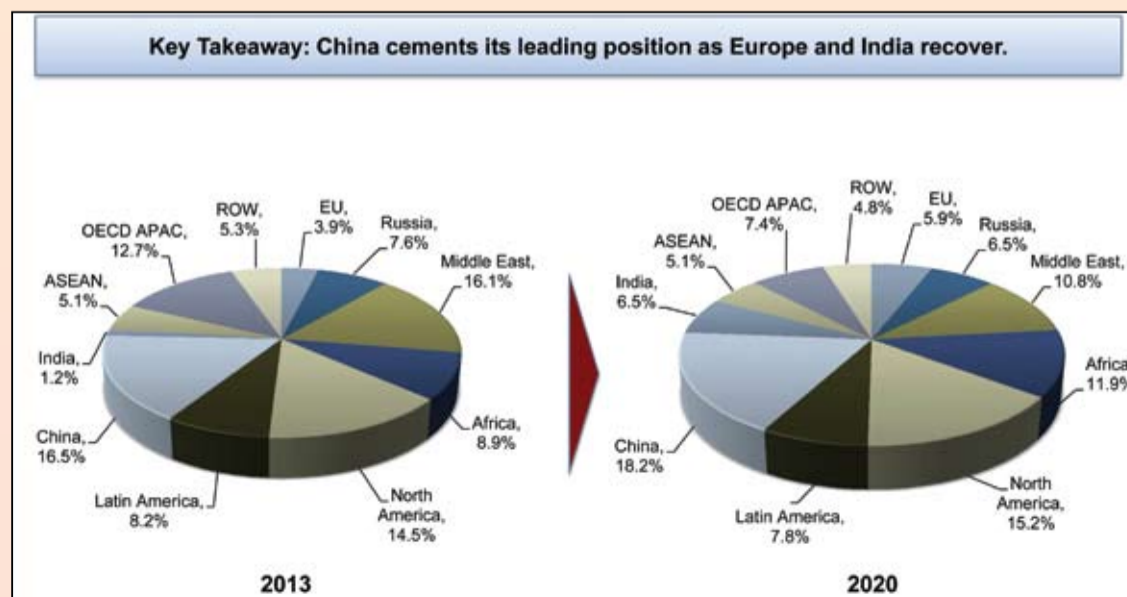


stations as well as the growing availability and usage of natural gas in power generation. Market participants, it says, are also feeling optimistic due to the expansion of the global oil and gas industry, and the need for more flexible generating assets, as a

levels rising in excess of 5 per cent annually from 2015 onwards.

Growth then trails off towards the end of the forecast period as emerging markets become more mature and renewable energy becomes a more attractive proposition for large-scale

Gas turbine market: per cent orders forecast by region, global, 2013 and 2020



Technology

A shot in the arm for thermal storage

Under its SunShot Initiative the US Department of Energy is stepping up activity on a novel thermal energy storage system. **Junior Isles reports**

Solar thermal plants allow solar power to be delivered around the clock in a flexible way. However, the most popular energy storage medium used for these plants, i.e. molten salt, suffers from one key technical limitation – the temperature it can reach is limited to around 560°C, which in turn limits the efficiency of the power cycle and the opportunity for cost reduction.

As part of its effort to make solar cost competitive, the US Department of Energy (DOE) through its SunShot Initiative is supporting research and development of concentrating solar power (CSP) plants and new thermal energy storage (TES) systems.

In June this year, the CSP programme took an important step with the announcement that the DOE has selected Spanish solar developer Abengoa, together with the National Renewable Energy Laboratory (NREL) and the Colorado School of Mines (CSM), to develop a new solar storage technology for thermo-electric plants.

for expensive metal alloys and insulation.

NREL's system uses gas/solid two-phase flow as the heat-transfer fluid and separated solid particles as the storage medium. The gas/solid particle system uses fluidized bed technology for heat exchange and packed particles for TES. When the particle-TES is implemented in the fluidized bed (FB)-CSP plant, the hot-solid particles discharge from the TES hot silo and enter the FB-heat exchanger where thermal energy is released to heat the power cycle fluid. This fluid enters the turbine for power generation. The separated cold particles returning from the power system circulate through a particle receiver for solar heat absorption and for charging the particle-TES.

Under this latest development, NREL and its project partners will explore the possibilities of a system that uses perovskite-type oxide as the storage medium.

The original mineral perovskite (CaTiO₃) was discovered in the Ural mountains of Russia by the German mineralogist Gustav Rose in 1834. Perovskite oxide has the ability to store large amounts of energy, which in turn enables higher temperature power cycles.

Cristina Prieto, Abengoa's Head of Project noted: "In order to increase efficiency, we need a higher temperature cycle, with a higher temperature fluid in a higher operating temperature reactor." Prieto says the perovskite oxide chemical storage cycle meets all these requirements. "Essentially the technology offers a more cost effective, dispatchable storage system. Also, the composition and structure of the particles allow for a more predictable reaction, which is good from a control aspect."

Perovskite oxides are mixed metal oxide solids that can store sensible energy through solar absorption and chemical energy from high temperature reduction.

During the charging process, the energy from the sun is used to heat up the solid particles and produce an endothermic reaction in a solar receiver. During the discharging process, the particles undergo an exothermic re-oxidation reaction within the reactor. The sensible energy

stored as well as the chemical energy released from the re-oxidation reaction heats up the power cycle fluid.

According to Prieto, the project allows for significant learning in solid particle cycles as well as thermo-chemical cycles in general.

One of the main technical parameters of this cycle is the storage density. The goal of project is to identify a perovskite oxide that has a storage density that exceeds 750 kJ/kg and a temperature higher than 700°C.

Developing the system is not without its challenges. To progress the technology towards commercialisation, the research will focus on identifying and mitigating risks associated with the process. As Prieto pointed out: "There can be multiple challenges depending on the choices made."

The particle receiver design, she says, is critical for reaction control. "It has to provide high absorption efficiency and enough residence time allows the reduction to reach completion. The reduction reaction also requires controlled conditions and reasonable residence time to allow the particles to return to their pre-reaction state."

NREL is responsible for design and testing of critical components based on its previous inert particle research. Abengoa is serving as a sub-contractor to CSM and will be monitoring the synthesis and characterisation performed by CSM for a better understanding of the process.

The project basically has two phases. The first, lasting about one year, will look at perovskite material synthesis and characterisation, preliminary development and undertake an economic analysis. There will then be a go or no-go decision before embarking on the second phase. If there is a green light, the second phase will involve a small-scale demonstration, in the range of kilowatts, of the reduction cycle interfacing with a heat source.

Synthesis and cost reduction of the perovskite are now under way. "We are focused on the analysis part of the cycling of this material," said Prieto. "After this validation, the plan is to continue with the design of the other critical components."

Ultimately Abengoa will perform an economic analysis of the overall cycle to assess commercial feasibility.

Although the installed system costs are still being investigated, the company says the main costs are associated with the storage container, particle conveyance system, the receiver and the heat exchanger.

With the DOE's target of making solar cost competitive by 2020, Prieto says the DOE's goal is to develop a system that can deliver electricity at less than \$15/kWh. NREL analysis predicts costs could be well within this target. To serve for readily realisable power system integration, it has carried out analysis based on a conventional 100 MWe steam plant with 42.5 per cent cycle efficiency.

Based on this power system assumption, NREL calculated 6-, 8-, 12-, and 16-hour TES storage capacities. An estimate of material and labour indicates that the FB-TES cost could be \$5-7/kWh – less than half of the DOE SunShot TES cost target and less than a quarter of the current TES cost estimated at \$30/kWh.

Nevertheless, it is still early days for the technology. "The goal of this project is to develop a scale particle receiver reactor and an oxidation reactor to validate the modelling behind the perovskite oxide redox cycle," said Prieto. "The commercialisation of the technology is not the focus of this DOE project, although the steps within the project will have commercialisation in mind."

There will be a study of different perovskite candidates, which will include an assessment of the production methods and the ability to scale up the process to full production.

Prieto explained: "The prototype developed needs to have a scalable design. Once the initial design has been proven, an industry developer can be brought in to assess the manufacturability of the prototype and the cost impact of a general increase in size."

At this stage, the feasibility of the technology does not have to be proven using solar energy, therefore, Prieto notes that another step towards commercialisation will be an "all sun" demonstration plant. "To assess the thermo-chemical system performance there will have to be a pilot plant that has all the components within the process i.e. the receiver, heat exchanger and the particle conveyance system."

The SunShot Initiative

Launched in 2011, the US Department of Energy's SunShot Initiative is a key part of the Obama Administration's action plan to combat climate change.

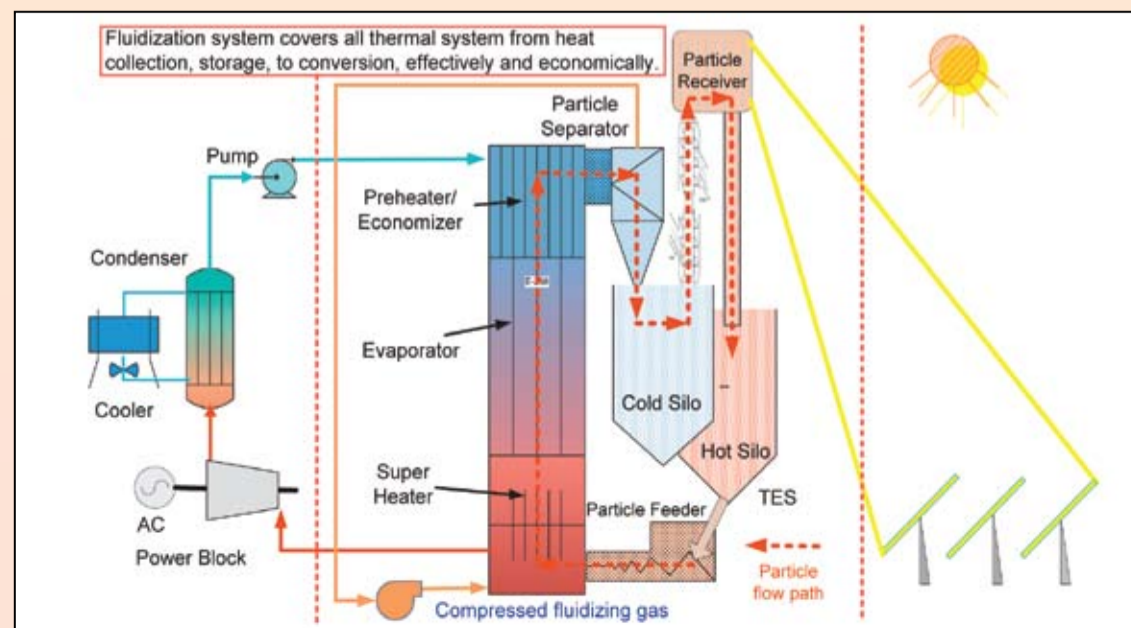
The goal of the initiative is to reduce the total costs of photovoltaic solar energy systems by about 75 per cent so that they are cost competitive at large scale with other forms of energy without subsidies before the end of the decade. By reducing the cost for utility scale installations by about 75 per cent to roughly \$1/watt, solar energy systems could be broadly deployed across the country.

The Initiative aims to reduce the total installed cost of solar energy systems to \$.06/kWh by 2020. Today, SunShot is 60 per cent of its way toward achieving the programme's goal, only three years into its 10-year timeline. Since SunShot's launch, the average price per kWh of a utility-scale photovoltaic (PV) project has dropped from about \$0.21 to \$0.11.

The project is the next stage of ongoing work by NREL that has estimated the cost and performance of a novel TES.

NREL's gas/solid particle system uses fluidized bed technology for heat exchange and packed particles for TES

Compared to today's current solutions, the system is designed to hold large capacity thermal energy for a longer time period without the need





Junior Isles

From muddle to model?

It may once have been seen as a muddle but of late, the UK's Energy Market Reform (EMR) package is increasingly being held up as a model of how power markets can be redesigned to suit energy landscapes that are becoming ever more green.

Not so long ago economist Dieter Helm, a professor at Oxford University, said that the UK government's attempt to overhaul the electricity sector would end up in a "hell of a mess", adding that if the government did not adopt a more simplified approach to policy, there would be another energy review immediately after the next general election.

According to Helm it was a scenario that would not provide a suitable environment for utilities to invest in building new capacity.

So far he has not been proven wrong, at least not when speaking of new fossil fuelled plants. But it has been quite a different story for renewables. Wind, despite a short hiatus due to the transition and the uncertain period before Britain announced the changes in support mechanisms, has seen strong growth. It has been a similar story for solar and waste-to-energy, and the marine energy sector is also beginning to bear fruit.

Certainly the UK has been tweaking and adding clarity to its electricity market overhaul since it published its EMR White Paper in 2011, resulting in a period of uncertainty. Several heads of utilities and industry observers from both inside and outside of Britain expressed dismay at the complexity of the new market, which is designed to promote low carbon generation while keeping the lights on. But as the finished package has taken

shape, other countries appear to be warming to the UK approach.

Despite the Fukushima disaster, in late August Japan said it was looking to maintain support for its nuclear industry. With impending deregulation, the government is assessing how it can ensure continued investment in the nuclear power sector.

The government is therefore considering a tariff support system modelled on Britain's Contracts for Difference mechanism. The current thinking is that a strike price will be set that reflects the huge costs of decommissioning a nuclear plant and the management of

Last month, E.On's CEO Johannes Teyssen said: "Britain offers a good example of how to redesign the power market to address the deficiencies of the energy-only markets in combination with the high and growing share of intermittent renewables. Germany is still far behind."

According to its latest figures, E.On plans to close 7741 MW of capacity from 2013 through next year, including its 1275 MW Grafenrheinfeld nuclear plant.

According to US-based research company Pira Energy Group, utilities in Germany need to shut 7 GW of

a second-quarter loss. "This does not bode well for security of supply, to which wind turbines and solar panels cannot make a large contribution."

Despite its problems in Germany, RWE has not yet abandoned Britain as it once said it would. Although its fossil fired plants remain under intense pressure, the company recently said Britain's renewables market is "attractive".

While Britain is no doubt proud to receive international recognition of its reform policies, it is too early for the government to start patting itself on the back. Parts of the EMR package, although approved by the EU, are still a work in progress.

In a statement issued at the start of August, the Department for Energy and Climate Change (DECC) promised to amend the latest draft of the capacity market rules to ensure existing coal plants are excluded from lucrative 15-year contracts potentially worth billions of pounds.

The announcement was made after journalists approached DECC officials with analysis by Greenpeace showing proposed rules could see subsidies worth up to £10.5 billion handed out to old coal-fired power stations. This level of state aid would keep these ageing plants in business for decades to come, undermining government efforts to cut carbon emissions.

If the government follows through with its promise, existing coal plants will not be eligible for multi-billion-pound deals but would still be allowed to bid for 1-to-3-year contracts worth tens of millions.

The capacity market will be an even greater boon for gas fired generation. Although needed to provide system flexibility by complimenting intermittent renewables, numerous gas fired plants have been mothballed across Europe during the last year.

Despite a recent reprieve, it is a situation that is likely to continue without an attractive capacity mechanism. A *Platts* survey sample of natural gas used in power stations in the UK, Belgium, Italy, the Netherlands and France showed that consumption of the fuel grew 6 per cent in July. According to *Platts*, this was due to generators switching away from coal to take advantage of lower gas prices.

However, the ongoing dispute between Russia and Ukraine does not bode well. Ukraine passed a bill on August 14, allowing the country to impose sanctions on Russia, potentially disrupting flows to Europe. Russia meets about 30 per cent of Europe's gas needs, half of which travel through pipelines crossing Ukraine.

The dispute is already having an impact on gas prices. UK gas for September delivery climbed as much as 2.2 per cent to 44 pence a therm, the highest since June 16, on the ICE Futures Europe exchange. Prices continued to rise in mid-August as tensions in Ukraine escalated. Dutch gas for September delivery on the Title Transfer Facility hub rose 0.9 per cent to €18.52 (\$24.79) a megawatt-hour, while the equivalent contract on Net-Connect Germany advanced 1.1 per cent to €18.65 a megawatt-hour, according to broker data.

As the Russia-Ukraine situation plays out, Britain is preparing for its first competitive capacity auction in December. It will be interesting to see what the auction delivers. Certainly it will be a moment of truth for UK energy policy and a chance to get an insight as to whether it is indeed a model or a muddle.

DECC promised to amend the latest draft of the capacity market rules to ensure existing coal plants are excluded from lucrative 15-year contracts potentially worth billions of pounds

spent fuels. When the market price falls below the strike price, the difference will be supplemented.

The ramifications of Fukushima have also to some degree persuaded others to look to the UK for ideas on policy.

Germany, whose utilities have been struggling in the face of the nuclear phase-out and the accelerated shift towards renewables, is now holding up the UK as an example of how a country can green its energy mix while safeguarding electricity supply. The likes of RWE and E.On, which have been hard hit by the changing energy landscape, cannot afford to run the baseload fossil plants needed to ensure system security that is being jeopardised by the growing amount of intermittent renewables.

coal-fired power plants by 2016 in addition to the closures already announced.

Both E.On and RWE would like to see Germany adopt a system of capacity mechanisms, such as that recently adopted in Britain, that pays utilities to keep coal and gas plants connected to grids to provide additional capacity at times of high demand.

In mid-August RWE AG said it will close an additional 1005 MW of coal and lignite plant by the first quarter of 2017, taking the total planned cuts to 8940 MW.

"Far more secured capacity will probably be taken off the market than will be added through investments," RWE Chief Executive Officer Peter Terium said as the company reported

