

THE ENERGY INDUSTRY TIMES

June 2014 • Volume 7 • No 4 • Published monthly • ISSN 1757-7365

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Special Project Supplement

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Battle for Alstom heats up

Immelt: the combined businesses would be a "true global power leader based in France"

A French parliamentary committee weighs up whether GE or Siemens would be the best buyer for Alstom, as Siemens prepares to launch a formal counterbid for the company. **Junior Isles**

The battle for the power business of French engineering giant Alstom escalated at the end of May as Siemens prepared to launch a formal bid to counter a cash offer tabled by GE.

Alstom has accepted a €16.9 billion offer from GE for its energy division, but has left the door open for a rival bid from Siemens in a sale process that is likely to be decided by French politics.

The two companies recently faced a French parliamentary committee to outline their plans to buy the power business of the French company.

GE Chief Executive Jeff Immelt told the committee that France would have greater influence in the global

power industry if the GE deal went through, as well as more decision-making headquarters and research and development spending.

He noted: "Alstom will not be absorbed by GE; rather the combined businesses will be a true global power leader based in France."

In addition to its cash offer, GE is making a number of concessions to appease the French government on issues such as access to technology, French ownership of part of the business, and employment.

GE said it will also allow Alstom to buy or form a joint venture with GE's railway signalling business. Further, it would put the offshore wind and

hydroelectric power operations that would be bought by GE into a separate subsidiary that could be part-owned by French investors.

GE has also given assurances that French nuclear power generators would have continued access to Alstom technology and servicing for their steam turbines, and promised net growth in jobs in the businesses it acquires.

Siemens, meanwhile, is expected to transfer its rail activities and less than €7 billion in cash to its French rival in exchange for its power assets. This would allow the French government to boast the creation of a new European rail champion.

Christophe de Maistre, head of Siemens France told the committee: "Strengthening Alstom by bringing all our rolling stock... will enable it to reach critical mass."

In addition to offering its rail activities, Siemens would propose creating a joint venture with Alstom in rail signalling. *Reuters* reported that Siemens was keen to retain a controlling stake in any signalling venture, potentially another source of conflict as Alstom is also eager to have a majority share. How the signalling stakes are divided up would affect the cash component of the Siemens bid, *Reuters* added.

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Rolls-Royce to re-focus after Siemens sale

UK engineering company Rolls-Royce (R-R) Holdings plc is to focus on its marine business and growing its civil nuclear power activities after agreeing to sell the bulk of its energy unit to Siemens AG.

Under the agreement R-R will sell its aeroderivative gas turbine and compressor systems businesses to Siemens for £785 million (\$1.3 billion). It will receive another £200 million for a 25-year licensing agreement for intellectual property relating to gas turbines.

Just ahead of the sale RBC Capital analyst Robert Stallard said: "From a management perspective, we think energy has been an unnecessary distraction that's margin dilutive, while the nuclear assets remain strategic and relatively self-sufficient."

On announcing the deal, R-R's

Chief Financial Officer Mark Morris noted that the company invests about £15-20 million each year in its civil nuclear business and "continues to win new contracts" in its instrumentation and controls business.

The disposal comes after R-R determined the power generation business lacked scale to be globally competitive. According to R-R the businesses sold would "highly complimentary" to Siemens, especially in oil and gas. "The sale to Siemens has clear industrial logic," noted Morris.

The sale could bring a much-needed boost to Siemens' energy business, which reported a second-quarter profit of €255 million, 54 per cent lower than in the same period last year.

Some of the factors that contributed to this are charges of €48 million, caused by a malfunction of bearings

in some onshore wind turbines, and €287 million charges for two HVDC projects in Canada.

Siemens reported a mixed earnings performance in the first three months of the year, the company's fiscal second quarter. Net profit rose 12 per cent to €1.153 billion (\$1.61 billion). But revenues fell 2 per cent to €17.78 billion, and new orders slipped 13 per cent to €18.43 billion. New orders are key to the company's future profits as it delivers large projects with long lead times.

Last month Siemens launched a sweeping restructuring to raise profits and better compete with peers such as GE.

CEO Joe Kaeser is eliminating the company's four broad sectors overseeing its businesses, and will cut those business divisions from 16 to

nine. Each division will have a profit margin target as Siemens aims to focus on fields where it can grow and earn the most.

The company is also cutting out the sector level of management to reduce bureaucracy, cut costs and speed up decisions.

As part of the re-organisation Lisa Davis, a manager at Royal Dutch Shell plc, will replace Michael Stüb as CEO of Siemens Energy, who is resigning for personal reasons. She will also join the management board, effective August 1 and will be based in the US.

■ Weir Oil & Gas and Rolls-Royce Power Systems company MTU announced that they have signed an agreement to develop power systems specifically engineered for hydraulic fracturing.

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According to sources Siemens would also exclude some Alstom energy activities – nuclear, wind energy, and transmission and distribution (T&D) – from its bid.

Excluding Alstom's nuclear and wind businesses from its bid could allow the French group to sell them directly to state-controlled energy firm Areva. But it could also create problems as one source close to the French camp said it would be difficult to separate the nuclear side of the turbine business from non-nuclear activities. The T&D business, valued at €1.5-2 billion, could be excluded as it might present Siemens with regulatory hurdles given the dominant position Siemens already holds in the sector.

GE has extended the time until June 23 for Alstom to make a formal decision on its offer and enter into exclusive talks. Urged by French ministers to make a counter-offer, Siemens said it would submit a formal bid by June 16.

But some people close to French stakeholders are sceptical of Siemens' intentions. One told the *Financial Times*: "They [Siemens] are not taking this seriously. They aren't delivering what is expected of them. Their major intention is to contribute to GE's failure [in the bid process]."

Olivier Esnou at Exane BNP Paribas told clients before the committee hearing: "Our view remains that [project] execution is a bigger issue of Siemens and we think the probability of Siemens eventually making a counterbid against GE is very low."

Siemens' new CEO Joe Kaeser



Esnou: the probability of Siemens making a counterbid is "very low"

insisted, however, that Siemens was serious about a potential offer and that any other agenda would be "disrespectful to anyone in France and outside France".

Siemens has been warned by several investors not to bid for Alstom. Christoph Niesel, senior portfolio manager at Union Investment, a major Siemens shareholder, said: "We view a possible deal with Alstom very critically, in particular because the priorities of Mr Kaeser's recently introduced reorganisation plan lie entirely elsewhere."

The *FT* reported that a German banker not involved in the talks said the feedback Siemens had received from some investors had been "horrible".

He added: "Mr Kaeser knows he has to be careful. His approach seems to be politically friendly but on the price side he's not going to be too aggressive."

Although no formal bid was on the table at the end of May, the French government appears to be in favour of a Siemens offer.

In mid-May, French Economy Minister Arnaud Montebourg issued a decree giving the government the power to block the GE deal. The decree allows the government to veto foreign investment in energy, water, transport and other sectors deemed strategic to the country.

Russia-China gas deal may affect Europe

A \$400 billion deal for the supply of Russian gas to China strengthens Russia's hand in the global energy landscape and reduces its dependence on deliveries to Europe. Junior Isles

Russia's long-awaited deal to supply natural gas to China may affect gas prices in Europe and have an impact on international liquefied natural gas projects.

On signing the 30-year gas supply contract worth more than \$400 billion last month, Gazprom Chief Executive Alexei Miller said: "This is the contract, which will influence the whole gas market. It can be assumed that the signing of the contract will affect gas prices on the European market."

Miller added that the deal would also have an impact on LNG projects in eastern Africa, Australia and western Canada.

The agreement calls for Russian government-controlled Gazprom to

supply state-owned China National Petroleum Corp. with 38 billion cubic metres (bcm) of gas annually from 2018.

This would represent about a quarter of China's current annual gas consumption of nearly 150 bcm, helping to ease gas shortages and curb the country's reliance on coal.

While the contracted gas price was not disclosed, industry sources said it was between \$350 and \$380 per 1000 m³, similar to what most European utilities pay under discounted long-term contracts signed in the last two years. Russia and China also agreed on a \$25 billion prepayment under the supply deal.

Importantly, the contract gives

Moscow an economic boost at a time when the US and the European Union have imposed visa bans and asset freezes on dozens of Russian officials and several companies over the dispute with Ukraine.

The contract opens up a huge new market for Gazprom, which generates around 80 per cent of its revenue from Europe, where demand is stagnating and profits are falling.

Keun-Wook Paik, senior research fellow at the Oxford Institute for Energy Studies said the agreement "opened the door for Russia to enter into Asia's gas market".

The contract is "particularly important" at a time when Europe has threatened to cut gas imports and reduce its

dependence on Russia because of the Ukraine crisis, said Alexander Lukin, a deputy head of the Russian Diplomatic Academy under the country's Foreign Ministry, quoted by the *RIA Novosti* news agency.

"We will be able to show to Europe that we have other customers," Lukin said.

Gazprom has yet to build a pipeline, which would begin carrying gas to China in 2018. The pipeline is expected to link China's northeast to a line that carries gas from western Siberia to the Pacific port of Vladivostok. The development of a gas centre on the Pacific will also allow Russia to export to markets in Japan and South Korea.

UK proposes legislation to ease fracking

■ Operators will have a right of access underground ■ Fracking "won't deliver anytime soon"

The UK has moved to provide a boost to shale gas operators and encourage investment in the UK's embryonic shale gas industry, in spite of objections from environmental groups.

Last month the government announced proposals to change legislation so that underground land can be used for fracking and geothermal operations. The announcement followed a House of Lords Economic Affairs Committee report entitled, 'The Economic Impact on UK Energy Policy of Shale Gas and Oil' which stresses that the development of shale gas in the UK should be recognised as 'an urgent national priority'.

Under the proposals, operators would have a right of access for shale gas and deep geothermal operations below 300 m.

The shale gas and geothermal industries have put forward a voluntary payment of £20 000 (\$32 000) per lateral

well that extends by more than 200 m (with payment made only once where laterals coincide). A system of landowner notification is also required to be delivered by the industry. The government's consultation is now seeking feedback on the proposals.

Catherine Howard, a senior associate at global law firm Herbert Smith Freehills, said: "The change in law would remove one of the main obstacles to investor confidence. At present the only way operators can use underground land for fracking is to obtain the consent of all landowners above, or apply to court for the grant of compulsory rights under the protracted Mines (Working Facilities and Support) Act 1966 procedure. It is unlikely that any shale gas operator would attempt to go through this process, as the cost and time delay would be prohibitive."

A UKOOG (United Kingdom

Onshore Operators Group) commissioned report prepared by EY and published in late April claims that the development of shale gas in the UK could create a £33 billion investment opportunity for British business with the potential to create over 64 000 jobs over an 18-year timeframe.

However, the study entitled 'Getting ready for UK shale Gas' warns that the UK needs to work now to lay the foundations for the necessary infrastructure, supply chain standards and skills requirements before developers look overseas.

Although the UK and some countries in Europe believe shale gas has the potential for reducing energy costs and providing energy independence, not all are convinced.

Statoil's CEO Helge Lund recently told *Platts Energy Week* that unconventional natural gas from shale formations will not be developed in

Europe anytime soon because of the continent's population density and a lack of fiscal and popular support for shale gas.

Commenting on the report by the House of Lords Committee, Nick Molho, Head of Climate and Energy Policy at WWF-UK, said: "The Lords seemed to have overlooked the many serious analysts who have said that shale gas in the UK is unlikely to have much impact on either gas prices or the UK's rising exposure to gas imports."

Greenpeace UK chief scientist Dr Doug Parr argued: "Fracking is a non-solution – it won't deliver for many years, if ever."

He also stressed that the report came just days after a survey revealed 74 per cent of the British public oppose plans to allow fracking firms to drill under people's homes without their permission.

Progress on clean energy "remains bleak", says IEA report

The International Energy Agency's (IEA) latest 'Energy Technology Perspectives' (ETP 2014) report has warned that while clean energy technology deployment in emerging economies has rallied over the past year – making up for declines in the industrialised world – the overall picture of progress remains bleak.

Indeed, the level of progress described in the 2014 report, launched during the Fifth Clean Energy Ministerial meeting in Seoul, Korea, is arguably less than what was documented in the IEA's previous tracking report.

Didier Houssin, IEA Director of

Sustainable Energy Policy and Technology said: "We are continuing to respond to the energy system as it evolves rather than actively managing its transformation in a holistic way. The ETP shows how technology helps us meet our goals and the time is now."

The IEA notes that electricity will play a defining role in the first half of this century as the energy carrier that increasingly powers economic growth and development.

David Elzinga, Energy Technology Analyst with the IEA and author of the report, predicted a growth of 80-130

per cent by 2050 in all scenarios but noted "electricity growth is not necessarily a good thing".

The specific theme of ETP 2014, *Harnessing Electricity's Potential*, reflects the convergence of two trends: rapidly rising global electricity demand and the need for increased system integration. Electricity's overall share of total energy demand has roughly doubled over the last 40 years, but the bulk of power generation today is hardly "low-carbon".

Electricity production uses 40 per cent of primary energy and produces an equal share of energy-related CO₂

emissions. However, cost-effective, practical solutions can increase efficiency, moderate electricity demand and decarbonise almost all power generation by 2050, says the IEA.

The report also finds that \$44 trillion in investment is needed to secure a clean-energy future by 2050, but says this represents only a small portion of global GDP and is offset by over \$115 trillion in fuel savings. The new estimate compares to \$36 trillion in the previous ETP analysis.

Houssin commented: "The longer we wait to transform our energy system the more expensive it will get."

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Coal sector braced for new EPA rules

President Obama is pushing ahead with proposals to limit carbon emissions from existing power plants, a move that critics fear will mean the end of coal-fired generation in the USA. **Siân Crampsie.**

The US Environmental Protection Agency (EPA) is expected this month to unveil proposals to limit greenhouse gas emissions from existing power plants.

The proposals would represent a milestone in US President Barack Obama's long battle to limit carbon pollution and fight climate change, but the country's coal lobby say that the new rules would be "the nail in the coffin" for coal.

The EPA was expected to propose new limits on existing power plants on June 2, 2014. However, because the Clean Air Act does not let the government directly regulate emissions from existing plants, the EPA will only issue guidelines for states to follow.

The EPA also says that the standards to be proposed for existing plants are likely to be different from and less stringent than standards proposed for emissions from new power plants.

Nevertheless pressure groups such as the American Coalition for Clean Coal Electricity (ACCCE) are concerned about the impact that the regulations would have on the US economy and its coal industry.

ACCCE said in May that new EPA regulations would lead to the closure of up to 69 GW of coal-fired capacity

in the US. Natural gas would become the major fuel source for generation, its says, leading to high energy prices and threats to grid reliability.

Limiting emissions from the electricity sector is a cornerstone of Obama's energy policy. The electricity sector accounts for 38 per cent of total carbon emissions in the USA, with coal plants accounting for three-quarters of those emissions.

Obama is therefore keen to see the regulations implemented before his term ends in January 2017 but Democratic candidates running for election in this year's Congressional elections are unhappy about the timing of the EPA's announcement.

Obama needs to move his plans forward, however, if they are to be implemented before the end of his presidency. After the EPA unveils the proposals, there will be a one-year consultation period. States will then have a full year to submit implementation plans, by June 2016. The EPA will then review each plan and either accept it or return it for revision.

Legal battles are also likely, say analysts.

The EPA has already proposed emission limits for carbon from new power plants, setting limits for future

coal- and natural gas-fired power plants measured as tons of greenhouse gas emissions per MWh of electricity produced.

The proposals rule out the construction of conventional coal-fired power plants, say critics, and mean that no new coal-fired plants will be built in the US because carbon capture technologies are not yet commercial.

In April Southern Company said it would take a \$380 million charge in the first quarter of the year to reflect rising costs at the Kemper clean coal power plant project in Mississippi.

The 582 MW coal gasification project is due to start operating at the end of 2015 but has been beset by delays and cost overruns.

In May *TEITimes* reported that another gasification plant – Duke Energy's Edwardsport generating station in Indiana – had been hit by operational problems.

The 618 MW Edwardsport plant began operating in June 2013 and cost \$3.5 billion to build, far more than the original \$1.9 billion cost estimate.

Another clean coal project in the pipeline in the USA – the proposed FutureGen plant in Illinois – moved forward last month, as state regulators approved its 45 km carbon dioxide pipeline.

Chile sets out four-year energy plan

Chile is boosting investment in the energy sector in a bid to overcome looming shortages.

President Michelle Bachelet has announced plans to increase investment in renewable energy as well as oil exploration and natural gas infrastructure to meet rapidly growing energy demand.

Bachelet said that solar panels would be installed on all public buildings as part of the \$250 million, four-year energy plan. She also unveiled plans to expand a liquefied natural gas terminal, and said that the government would provide \$400 million of funds to the state oil firm to expand exploration activities.

In the renewables sector, Bachelet set a target of sourcing 45 per cent of all new installed generating capacity from non-conventional renewable sources. This will help to improve Chile's energy security as well as keep electricity bills in check.

The average electricity bill in Chile has increased by 20 per cent since 2010. Bachelet hopes that plans to unify the country's two electricity grids and introduce more competition in the electricity sector will also reduce energy costs.

Studies show Chile must triple its

generating capacity in 15 years to continue growing its economy while satisfying demand from the key mining industry. It currently depends on hydroelectric power plants and imported fossil fuels for nearly all its power.



Bachelet: plans to increase investment in renewable energy and oil exploration

Enel wins IFC funds

The IFC says its support of wind power developments in Brazil will boost economic development as well as renewable energy deployment in the country.

The international lending agency is to provide \$200 million of finance to Enel Green power to support the construction of 300 MW of wind energy capacity in the states of Bahia, Pernambuco and Rio Grande do Norte in northeast Brazil.

The ten-year financing deal is the first between the IFC and Enel Green Power and will help to "accelerate

development of Brazil's renewable energy sector while also expanding electricity supply at a critical time", said IFC Brazil Country Manager Hector Gomez Ang.

He added: "Access to reliable power generation from diversified sources is a key component of Brazil's long-term competitiveness and sustainable social and economic growth."

Brazil operates 173 MW of wind capacity in Brazil as well as 93 MW of hydro capacity. It has an additional 331 MW of power projects under development.



Offshore innovators win DOE funds

■ Three projects win funds ■ 2017 deployment scheduled

The US government is to plough nearly \$150 million into the offshore wind sector to speed technology development and remove hurdles to the sector's growth.

The US Department of Energy (DOE) last month selected three offshore wind demonstration projects to receive up to \$47 million of funding each over four years.

The awards are part of the Obama Administration's plans to launch a sustainable offshore wind sector in the

USA and will help to reduce costs and improve the performance of utility-scale turbines in US waters.

The offshore wind sector in the USA has been slow to develop. Deepwater Wind is developing two offshore projects on the US east coast, and Cape Wind is developing a major project off the coast of Massachusetts. About ten other offshore projects are in the early stages of development.

The DOE has chosen demonstration projects off the coasts of New Jersey,

Oregon and Virginia and wants turbines deployed by 2017. The projects have been proposed by Fisherman's Energy, Principle Power and Dominion Virginia Power.

Fishermen's Energy will install five 5 MW direct-drive wind turbines approximately 5 km off the coast of Atlantic City, New Jersey. This project will utilize an innovative, US-developed twisted jacket foundation that is simpler and less expensive to manufacture and install than traditional

offshore wind foundations.

Principle Power will install five 6 MW direct-drive wind turbines approximately 29 km off the coast of Coos Bay, Oregon. The US-developed WindFloat semi-submersible floating foundation will be installed in water more than 300 m deep, demonstrating an innovative solution for deep water wind turbine projects and lowering costs by simplifying installation and eliminating the need for highly specialised ships.

Dominion Virginia Power will install two 6 MW direct-drive wind turbines 42 km off the coast of Virginia Beach, utilising a US-designed twisted jacket foundation. Dominion's project will demonstrate installation, operation and maintenance methods for wind turbines located far from shore. Additionally, the Dominion project will install and test a hurricane-resilient design to ensure that offshore wind facilities placed in hurricane-prone US waters are reliable, safe, and cost-effective.



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Japan nuclear shutdown could impact global fuel prices

Japan believes that the shutdown of its nuclear plants is not only affecting its own energy costs but also those globally.
Syed Ali

The ongoing shutdown of Japan's nuclear power plants may be pushing up global fossil fuel prices.

At a press conference last month Finance Minister Taro Aso argued: "The suspension of nuclear power generation has been affecting energy abroad and import prices (of other countries). As Japan has such great economic power, we have to consider this as an international issue."

Japan's energy costs have soared since the closure of its nuclear reactors following an earthquake and tsunami that crippled the Fukushima Daiichi nuclear power in March 2011.

The plant closures have led to soaring fossil fuel imports that have driven up the country's trade deficit. Last month, Finance Ministry data showed that current account surplus in fiscal 2013 through March was the smallest since comparable data became available in fiscal 1985.

Japan's goods trade balance in the

year was in the red for the third straight year amid robust demand for natural resources from utilities bolstering fossil fuel-based power generation as an alternative to nuclear power.

Aso commented: "To strengthen our international competitiveness, our basic policy should be to promote economic growth strategies further, including deregulation and structural reforms aimed at developing technologies and boosting investment returns."

Early proof of those structural reforms was in evidence in late May as Tokyo Electric Power Co. (Tepco), owner of the crippled Fukushima Daiichi nuclear plant, said it might begin selling power for the first time outside its service area in the Japanese capital and nearby prefectures by this autumn.

Tepco's move to expand its electricity retail sales across the country, initially in the Kansai and Chubu regions

centring on Osaka and Nagoya, respectively, comes amid intensifying competition against rival utilities entering its Tokyo metropolitan area.

The firm also aims to increase its sources for profit ahead of Japan's planned full liberalisation of its electricity retail market in 2016.

At the end of April the company said that it achieved profitability in fiscal 2013 (ended March 31) – the first time since the nuclear crisis.

Chubu Electric Power Co. also said it is expecting a group net profit of Yen12 billion (\$118 million) in the current fiscal year ending March 2015. This would be the first time the company has shown profit in four years.

Japan's decision to continue to support nuclear and restart its reactors will provide a welcome boost to the country's hard-pressed utilities.

In late May the government reiterated that it would stick to its energy policy decided in April, which pledged

to push for the resumption of reactors that have cleared what the government calls the "world's toughest regulatory standards".

The announcement followed a ruling by the Fukui District Court, which refused to let two reactors at the Ohi nuclear plant in western Japan restart operations. The court said their risk assessment was too optimistic and safety measures were insufficient in spite of lessons from the Fukushima disaster.

Meanwhile, ongoing decommissioning efforts at the crippled plant received a boost at the start of May. French company Areva and ATOX, a maintenance services for nuclear facilities in Japan, announced the creation of a 50:50 joint venture ANA-DEC to provide solutions and services in the field of decommissioning and dismantling of Japanese nuclear power plants. The joint venture will operate as early as this year at the damaged

Fukushima nuclear power plant.

The knock-on effects of Fukushima are still being felt elsewhere in Asia. State-run electricity supplier, Taiwan Power Co. (Taipower) has said that the government's decision to halt construction of the controversial Fourth Nuclear Power Plant is the same as sentencing the company to bankruptcy. The decision came after a meeting between President Ma Ying-jeou, who is also chairman of the ruling Kuomintang (KMT), Premier Jiang Yi-huah and KMT mayors and magistrates in late April. They agreed that the already completed no. 1 reactor will not be brought online once its ongoing safety inspections are concluded, and that construction of the no. 2 reactor, which is 91.5 per cent completed, will be halted. Taipower Chairman Hwang Jung-chiou said halting the construction means that the company cannot reclaim the \$93.7 billion it has already spent on the project.

China looks inward to combat anti-dumping duties

- Europe imposes anti-dumping duties
- Domestic solar target increased



China has increased its target for solar photovoltaic (PV) generation as its PV panel manufacturers come under pressure as the result of anti-dumping investigations.

Last month Australia's Anti-Dumping Commission said that it will examine the markets in Australia and China to determine whether Chinese companies have been selling products at less than the cost of manufacture or at unprofitable export prices.

Europe and the US have already imposed restrictions on imports of Chinese PV panels in a bid to protect their industries from a flood of cheap products. Chinese producers say they are able to cut costs through rapid expansion.

In mid-May the European Commission imposed definitive anti-dumping and anti-subsidy duties on solar glass imported from China after concluding that Chinese solar glass producers have been dumping their products on the EU market. The Commission imposed final anti-dumping duties of up to 36.1 per cent for Chinese solar glass manufacturers. Anti-subsidy duties will range from 3.2 per cent to 17.1 per cent. The duties came into force with immediate effect.

In the face of increasing pressure, China's PV industry issued a statement opposing the US' second anti-dumping investigation on Chinese PV products. The joint statement called for the US and China to solve the disputes through negotiations.

On February 14 this year, the US International Trade Commission (USITC) determined an affirmative indication regarding injury to the US industry as part of the new anti-dumping (AD) and countervailing duty (CVD) petitions against PV products from the Chinese mainland and Taiwan.

The US Department of Commerce is expected to release the preliminary AD investigation result on July 28 and final results on December 11. The USITC will determine whether to levy taxes on January 26, 2015.

It was the second US investigation against Chinese PV products after a similar one in 2011, which seriously affected the Chinese PV industry and hindered the development of the US PV market.

According to GlobalData, China became the global solar module production leader in 2013 and led both the demand and supply sides of the global market.

Ankit Mathur, GlobalData's Project Manager for Alternative Energy said: "China enjoyed a landslide victory in terms of crystalline module production in 2013, after it won a significant 70.4 per cent of the global market."

"The announcement of anti-dumping duties on Chinese module manufacturers, which export solar modules to European markets, has diverted their focus away from exports to increasing sales activities in their own fast-growing domestic market."

China's National Development and Reform Commission (NDRC) recently announced that it is planning to increase the country's solar target to 70 GW by 2017.

The Chinese government is currently targeting 35 GW of installed solar capacity by 2015. It had around 20 GW of operational PV capacity at the end of 2013, according to data compiled by Bloomberg.

The State Council said that the new plan would enable the domestic solar PV market to grow by an additional 10 GW annually over the next three years and would help the domestic solar industry to counteract oversupply and reduce its dependence on exports.

Philippines' power plans gain momentum

Plans for several large-scale base load projects aimed at helping ease chronic power shortages in the Philippines are gaining momentum.

The power unit of Ayala Corp. and its partner, Power Partners Ltd. Co. (PPLC), recently signed an engineering, procurement and construction (EPC) contract with Shanghai Electric Power Construction Co. (SEPCC) for the development of a \$1 billion thermal facility in Mindanao.

The construction of the thermal facility, which will have four 138 MW units, is scheduled to begin by the fourth quarter of this year.

It is the second of two EPC contracts awarded in quick succession. It was also reported that a consortium of Japanese firm Mitsubishi Heavy Industries (MHI) and Korean firm Daelim Industrial Co. Ltd. was awarded the EPC contract for the 400 MW expansion of the Pagbilao coal-fired power plant in Quezon province.

Meanwhile, Lopez-owned power generation company First Gen Corp. moved to strengthen its operations in the Philippines to help meet growing demand and eventually become a global energy player. The company says it is aiming to build an additional 1342 MW in generation capacity between now and 2019.

First Gen chairman and chief executive officer Federico Lopez said the company is planning to build three new plants including the 100 MW Avion, the first power plant in the country using aeroderivative turbines.

Separately, property developer San

Lorenzo Ruiz Builders and Developers Group Inc. (SLRB) will embark on four major hydroelectric power projects worth \$2.5 billion with a generation output of 1212 MW that will augment power supply, its top official said.

Construction of the Wawa hydroelectric power project in Rodriguez, Rizal; Bolusao River hydropower project in Eastern Samar; Davao hydropower project and Chico River hydropower project in Northern Luzon, will take three to four years.

The Philippines is therefore looking to other sources to provide near term capacity.

Marc Lohoff, CEO of Asia Pacific, Conergy, which last month completed phase one of the Philippines' first utility-scale solar park, said: "Conergy is working internationally with its partners to unlock the barriers to the wider adoption of solar, including in countries like the Philippines where the conditions are perfect."

"Utility-scale solar plants can be built quickly and cost-effectively, with relatively low operational and maintenance costs. When well designed, and properly constructed, they can play an important role in reducing pressures on domestic power generation."

In its first phase, the San Carlos City project features 13 MW of power capacity, which will be expanded to 22 MW in the coming months.

More projects are likely to follow as the country announced that it was extending its solar feed-in tariff allocation to attract more investment.

Europe News

OL3 delays hold back OL4 decision

- I&C tests for OL3 start
- Fortum switches I & C supplier at Loviisa

Teollisuuden Voima Oyj (TVO) says that electricity production from a proposed fourth nuclear reactor at Olkiluoto (OL4) would not start until the end of the next decade.

The Finnish utility is due to submit a detailed application for a construction license for OL4 by June 2015 but has asked the Finnish government for that deadline to be extended because of delays and cost overruns at Olkiluoto 3 (OL3).

If granted, the five-year extension would delay commissioning of the planned unit to the late 2020s, says the utility.

The Finnish government is also considering plans by Fennovoima to build a nuclear reactor at Pyhäjoki, north-west Finland.

The Finnish government says that it will not make a decision on the Pyhäjoki plant until August but the decision will be complicated by the need for each party in the ruling coalition – particularly the Green League – to consider its position.

Fennovoima signed a power plant

supply contract with Russian firm Rosatom in December 2013 and says that the 1200 MW plant will start producing electricity in 2024.

The OL3 plant was scheduled to start operating in 2009 but is still under construction with no firm completion date. TVO is currently in arbitration with the plant supplier – an Areva-Siemens consortium – over who will pay for the delays and cost overruns.

OL3 was originally estimated to cost just over €3 billion, but the final cost is likely to rise to €8.5 billion.

In April TVO reported that tests on the I&C system at OL3 had started in the Areva-Siemens test bay in Germany. “The tests conducted in Germany represent an important milestone in the progress of the project,” said OL3 Project Director Jouni Silvennoinen. “It is great that the tests can now be started according to plans.”

“This is an extensive test programme which will take at least until the end of this year to complete. At this point we cannot give an exact schedule.”

Last month Fortum switched

suppliers for a key project to modernise the I&C system its Loviisa nuclear power plant.

Fortum announced that it had terminated a contract with an Areva-Siemens consortium and signed a new contract with Rolls-Royce.

Rolls-Royce will deliver the automation systems including planning, testing and installations, with Metso as sub-supplier providing non-safety operational I&C, field design and implementation on site. The project will be completed by the end of 2018.

Modernisation of the Loviisa nuclear power plant’s automation system started in 2005. The reactor control system and automation for auxiliary systems were completed by the Areva-Siemens consortium at unit 1 in 2008 and at unit 2 in 2009. During the planning and testing of the next phase of the agreement, “it appeared that the implementation of the current project would have been further delayed from its original time schedule and would have taken too long to complete”, according to Fortum.

Gas storage sufficient to counter Ukraine crisis

Europe would be able to cope this winter with a disruption to supplies of natural gas from Russia caused by the current situation in Ukraine, according to new analysis from consulting group Pöyry.

The security of gas supplies has emerged as a key concern for European governments as tension between Russia and Ukraine heightens. Pöyry says that Europe has sufficient storage capacity to make up for a loss of supply through Ukraine.

Additional deliveries through Nordstream and small volumes of Central Asian gas and LNG would also help to make up the shortfall. “Whilst Europe has sufficient storage capacity to see it through next winter, it is important to stress that there must be sufficient gas in store at the start of the winter,” said John Williams, Senior Principal at Pöyry. “It is also crucial that gas is able to flow freely to the markets that will need it most and that national security of supply is not used as a reason to withhold storage gas from the market.”

Pöyry also warns that the outlook would be more uncertain if relations between Europe and Russia were to deteriorate further. Other potential crises include disruptions due to unexpected supply outages or infrastructure failure at interconnection points, storage or LNG terminals.

Eurelectric last month said that the best response to the Ukraine crisis could be found in existing European energy policies, including investment

in cross-border interconnectors and completion of the internal electricity market (IEM).

The European electricity association also said that the European Commission’s recent 2030 proposal would drive renewables growth as well as electrification and energy efficiency and would therefore “broadly improve Europe’s energy security by a sustainable, innovative and efficient energy use across all sectors”.

In May the European Commission approved a €60 million investment in a new interconnector between Poland and Lithuania. The link will be completed by October 2015 and will help to improve the integration of Poland’s electricity market with those of Lithuania, Latvia and Estonia.

EU Commissioner for Regional Policy Johannes Hahn said: “The issue of energy security and supply is vital for the EU, and we know how keenly it is felt, particularly in countries like Poland and the Baltic states at this time.”



Growing tension in Ukraine is raising concerns over European gas supplies

UK reins in utility-scale solar

- Large-scale projects to compete for CFDs
- UK to be largest European PV market

The UK’s solar photovoltaic (PV) sector is considering proposals for further changes to the subsidy schemes supporting the technology.

The government in May issued proposals to cease funding large-scale PV projects through the renewables obligation (RO) and to alter the feed-in tariff (FIT) scheme for smaller projects to encourage the development of roof-mounted solar schemes.

The Department of Energy and Climate Change (DECC) said that the proposals would help to maintain the momentum of growth in the UK’s solar sector while ensuring that consumers continue to get value for money.

The solar industry has criticised the

plans, however, with the Solar Trade Association (STA) claiming that the government has singled out solar for “unfair withdrawal of financial support”, while the Renewable Energy Association (REA) said that the proposed changes would bring “much new instability and confusion”.

NPD Solarbuzz said in April that the UK is on track to be the largest PV market in Europe in 2014. More than 120 large-scale solar PV farms in the UK have recently received project planning approval, and many of them are targeting completion within the next 12 months, it said.

DECC wants PV developments that are 5 MW or over in size to use the

new contracts for difference (CFD) scheme, being brought in under the UK’s electricity market reforms, from April 2015. It has also proposed changing the FIT scheme for solar schemes over 50 kW in size so that roof-mounted schemes would be favoured over ground-mounted projects.

The government said that the proposals would bring more balance to the solar sector, which has grown rapidly in the UK but which has become dominated by small-scale rooftop schemes in the domestic sector, and large-scale ground-mounted projects.

It is concerned that continued rapid growth of large-scale schemes would turn the tide of public opinion against

solar and wants to encourage industry to instead use the large, untapped potential of the commercial rooftop sector.

Under the proposals, which will be under consultation until June 10, 2014, projects over 5 MW in size would have to compete through an auction process with other renewable energy technologies for support from the CfD scheme.

The small and medium-sized companies that dominate the UK’s solar sector will find it hard to compete with big energy firms in the CfD market, says the STA.

“The costs of solar power have kept on falling, in large part thanks to the growth and learning in our successful

UK industry,” said Paul Barwell, CEO of the STA. “We had forecast solar could be cheaper than onshore wind by 2018, but for this to happen we needed stable policy sustaining a high-volume market. The government is actually moving to slow down solar’s cost reductions towards grid parity.”

“The industry will be alarmed by these proposals and surprised to be singled out for harsh treatment.”

Barwell added: “This feels like a kick in the teeth for exceptional performance. Our costs have dropped 30 per cent against offshore wind in two years and we have devoted a year to driving good practice throughout the industry. This is not a just reward.”

Ghana to host gas-to-power project

- 1100 MW developed by 2019
- \$800 million private investment in Ghana

Ghana is to host one of the largest power parks in sub-Saharan Africa after three consortium partners signed a joint development agreement to build the Ghana 1000 project.

GE, Endeavour Energy and Finagession will develop and implement the Ghana 1000 project, which will combine regasification facilities for imported liquefied natural gas (LNG) with gas pipeline infrastructure and power generating plants.

The project will be entirely developed, financed and operated by private sector partners and will supply

much needed energy to Ghana's national grid.

The first phase of the project is expected to begin delivering power by early 2017, initially producing 360 MW in simple cycle mode. When completed in early 2018, it will generate more than 540 MW in combined cycle mode. The second and final phase of the project is expected to be implemented before 2019.

The combined completion of all these phases will create a single power park capable of generating in excess of 1100 MW of power.

The Ghana 1000 consortium partners are currently exploring options with a number of international suppliers for the LNG aspect of the project. They are also in discussions with a Ghanaian trading company to handle the management and logistics of importing LNG.

Jay Ireland, CEO & President of GE Africa said: "The first phase of the project alone will require more than \$20 million of development capital, over \$200 million of equity from the project sponsors and more than \$600 million in debt financing."

Turkey boosts renewable prospects

Turkey has won the backing of the World Bank to expand its renewable energy sector.

The multilateral lending agency has approved a total of \$350 million of funding to support Turkey's Renewable Energy Integration Project (REIP), which aims to expand transmission facilities and facilitate the construction of large-scale renewable energy projects.

The funds are made up of \$300 million from the International Bank for Reconstruction and Development (IBRD) and \$50 million from the Clean Technology Fund (CTF). The project will be implemented by

TEIAS, Turkey's electricity transmission company.

Expanding renewable energy capacity is a key part of Turkey's energy policy alongside a major nuclear new build programme. The country has considerable wind energy potential but a number of barriers are inhibiting investors.

The IBRD and CTF funds will support the expansion of transmission infrastructure in key wind resource-rich provinces of Izmir, Çanakkale and Kırklareli, fund smart grid investments to improve grid management, and strengthen transmission networks.



Nigeria to add 3 GW of solar

Nigeria will add 3000 MW to its grid after signing agreements with solar power developer SkyPower FAS Energy.

SkyPower FAS Energy has signed a deal with the Nigerian federal government and Delta State government to develop, build and operate 3000 MW of solar photovoltaic projects.

The \$5 billion development would be an important boost for Nigeria's power system, which has been suffering from shortages for many years.

The 3000 MW of utility-scale solar PV projects will be built over the next five years, with commercial operation starting in 2015. SkyPower FAS Energy, a joint venture between solar power group SkyPower Global and Saudi Arabian firm FAS Energy, says it will "work closely with both governments for the planning, financing and construction" of the projects.

SkyPower FAS Energy said the agreements represented "a monumental renewable energy milestone".

It sealed the deal during the World Economic Forum on Africa as the Canadian and Nigerian governments signed a Foreign Investment Promotion and Protection Agreement (FIPA).

"The signing of these landmark agreements demonstrates the shared vision of a partnership that will further stimulate the vibrant, fast-growing Nigerian economy and substantially impact the state and country's GDPs, resulting in increased employment and skills training," said Kerry Adler, President and CEO of SkyPower Global.

"The total capital requirement for these projects is an estimated \$5 billion, which will be financed through a combination of bank debt, development bank financing, and equity partners. Over the life of the projects, it is estimated that more than 30 000 jobs will be created in Nigeria," said Stephen Bordes, Chief Financial Officer of SkyPower Global.

Saudi Arabia-Egypt power grid link moves closer

The blueprint of a project to link the power grids of Saudi Arabia and Egypt is in its final stages and the project may be offered for bidding by early next year, Undersecretary of the Saudi Ministry of Water and Electricity Saleh Al-Awaji has said.

"The electricity link between the two countries may be realised in the next three years after the start of the execution work," he said. "The project to link the two countries' electric grid has been based on thorough studies," he added.

Al-Awaji said peak power demand in Saudi Arabia is usually in the daytime between 13:00 and 17:00 while in Egypt it is between 18:00 and 22:00.

"Therefore the Kingdom can import electricity from Egypt during the daytime and re-export it in the evening," he said.

The official also said the need for power in the Kingdom drops in winter, while in Egypt it remains fairly constant throughout the year. "Hence there is an opportunity for the Kingdom to export electricity to Egypt in winter," he added.

Al-Awaji noted the Kingdom has electric links with the Gulf Cooperation Council (GCC) countries while Egypt is linked with eight eastern Arab countries, providing an opportunity for wider cooperation between countries in the MENA region.

Koeberg delay will hit Eskom supplies

- Medupi will ease supply margin
- EGP connects PV plant

Siân Crampsie

A project to extend the life of South Africa's only nuclear power plant has hit delays at the procurement phase.

Eskom, South Africa's national utility, was expected to select a supplier for the \$350 million refurbishment project early in 2014 but told local media in May that a decision was now likely to be made mid-year.

The project to replace the steam generators at the Koeberg plant was announced in 2012 and forms part of South Africa's overall plan to upgrade and expand generating capacity, including the addition of 9600 MW of nuclear power by 2030.

The country is currently managing a severely constrained power system because of a combination of cold weather, maintenance at generating units and underlying economic growth. It has called on consumers to voluntarily curtail energy use in

order to prevent load shedding.

In 2012 Eskom requested submissions of interest from bidders to design, manufacture and install three steam generators in each of Koeberg's two units. Bids have reportedly been submitted by Areva and Westinghouse, and Eskom had originally intended to award the contract at the end of 2013 with a view to work being completed by the end of 2017.

The replacement of the generators would enhance the efficiency and extend the life of Koeberg, which has been in operation since 1984.

In March, unit 2 at Koeberg was shut down for scheduled refuelling, maintenance and inspection. It was scheduled to be back on-line by the end of May to help Eskom ease the tight capacity margin situation.

The capacity margin is expected to improve further towards the end of 2014 when the first two units at the 4800 MW Medupi coal-fired power

plant come on line.

Elsewhere, South Africa is boosting capacity through the addition of renewable energy.

Enel Green Power said last month that it had connected its first solar photovoltaic (PV) power plant in South Africa.

The 10 MW Upington PV plant in Northern Cape Province is the first of several contracts signed by Enel Green Power to build capacity under South Africa's Renewable Energy Independent Power Producer (IPP) programme.

The Italian firm plans to install more than 300 MW of PV capacity in South Africa, as well as nearly 200 MW of wind power.

Enel Green Power will install four PV plants – Aurora, Tom Burke, Paleishewul and Pulida – in Northern Cape, Western Cape, Free State and Limpopo provinces using thin film PV modules supplied by 3Sun.



Delays ahead: Koeberg procurement

Nordex, Gamesa report strong 1Q performance

There is further evidence that strong growth in the global wind energy sector is once again emerging. **Siân Crampsie**

Rising global demand for wind turbines is boosting the fortunes of the manufacturers serving that sector.

Nordex last month reported a surge in first quarter sales and has raised its guidance for 2014 on the back of a better than expected business performance, while Spanish turbine manufacturing firm Gamesa reported a doubling of its first quarter net profits compared with the same period of 2013.

Nordex's management board has increased the firm's full-year sales and earnings guidance after a 64 per cent surge in sales in Q1 to a record level of €424.5 million. Cost cutting measures, better capacity utilisation and the execution of more profitable orders contributed to a higher gross margin of 24 per cent.

Gamesa ended the first quarter of 2014 with €17 million in net profit, more than double the figure posted in the same quarter of 2013, and an EBIT margin of six per cent. It said that the

figures reflected an improvement in profitability and a return to growth in business volume and revenues.

The results reflect recent forecasts issued by the Global Wind Energy Council (GWEC), which said that growth prospects for the global wind sector "look much brighter" for 2014 and beyond following a difficult year in 2013.

Nordex said that its order book was dominated by the Europe, Middle East and Africa region but added that sales in the Americas and Asia developed exceptionally well, rising to €124.1 million in Q1 2014, up from €14.5 million in Q1 2013. Gamesa reported that its recovery was supported by contribution to sales from India (33 per cent) and Latin America (37 per cent).

Gamesa also said that the recovery in the USA also helped its sales, while emerging markets such as the Philippines, Turkey and Sri Lanka maintained their contribution.

"This growth in business volume and

sales was achieved in a context of rising global demand following the decline during 2013," said a statement from Gamesa.

"Sound commercial and product positioning, geographic and customer diversification and a product portfolio focused on meeting market needs resulted in a doubling of order intake in the quarter, to 496 MW."

According to GWEC, policy uncertainty in the USA caused a 10 GW drop in the global annual wind turbine market in 2013. It expects 2014 installations to return to or surpass 2012 levels and increase by 33 per cent over 2013 levels. GWEC predicts that growth over the next five years will be concentrated in Asia, Latin America and Africa.

GWEC's latest analysis indicates that wind installations will reach 47 GW in 2014, dominated by North America and Asia. After 2014 it expects annual growth to return to more 'normal' levels of 6-10 per cent.

Energy Future Holdings restructures

Energy Future Holdings (EFH) says that it will take just 11 months to reorganise and refinance its business after filing for Chapter 11 bankruptcy protection in the USA.

The utility – formerly known as TXU Corp. – collapsed under the weight of its debt. Analysts believe that the firm's regulated unit, Oncor, will be separated from the rest of the business while other parts will be sold to help reduce the firm's \$40 billion of debt.

Dallas-based EFH owns three major utility operations: Luminant Generation, TXU Energy and Oncor, a power lines business covering most of north Texas. The bankruptcy is the tenth largest in US history and EFH says it expects all of its business to continue operating normally during the restructuring.

EFH hopes to write off \$26.1 billion of debt and raise financing to support current operations. Reports indicate that it could raise up to \$25 billion through the sale of TXU Energy,

which serves 1.5 million households in Texas, and Luminant, which operates 14 power plants with a combined 15 427 MW of capacity.

EFH was created in 2007 through the purchase of TXU by three private equity firms in what was the largest-ever leveraged buyout deal.

Investors were attracted by the company's large fleet of power plants. They counted on the expectation that power demand in Texas would rise and gas prices remain stable in order to recoup their investment.

However the economic recession cut demand and gas prices tumbled amid the shale gas boom. EFH has reportedly been in negotiations with creditors for months.

■ Exelon Corp. has agreed to pay \$6.8 billion to buy Pepco Holdings Inc., the utility serving the areas around Washington, D. C. Pepco's customer base would expand Exelon's business by two million meters in five states and the District of Columbia.



Shanghai Electric sets eyes on Ansaldo stake

Ansaldo Energia is set to boost sales in Asia after its parent company, Fondo Strategico Italiano (FSI) signed a long-term strategic agreement with Shanghai Electric to sell a 40 per cent stake in the Italian turbine manufacturer.

Under the agreement, Shanghai Electric will pay €400 million for a 40 per cent stake in Ansaldo as well as create two joint ventures with the firm for manufacturing gas turbines for the Asian market and the creation of a research and development centre in Shanghai.

In addition, the Shanghai R&D centre will launch a cooperation project

with Ansaldo's Genoa R&D centre to develop new gas turbine technology. The deal is expected to close by the end of the year.

FSI said in a statement that the deal would give Ansaldo improved access to Asian markets, which represent 50 per cent of the world market for gas turbines and which are undergoing rapid growth. It predicts a 20 per cent increase in turnover in the medium-to-long-term as a result of the deal.

FSI, Italy's state-backed investment fund, owns 85 per cent of Ansaldo Energia, a stake it purchased in December 2013 from Finmeccanica, the state-controlled defence company.

Foster Wheeler ready to address environmental challenges

Foster Wheeler is now better positioned to address global environmental challenges following the finalisation of its acquisition of Siemens Environmental Systems and Services, the business that supplies and services clean air technologies for use in power plants and industrial facilities.

The Siemens Environmental Systems and Services purchase includes assets of the former Wheelabrator Air Pollution Control Company located in Pittsburgh, Pennsylvania and the Advanced Burner Technology Company located in Branchburg, New Jersey, USA.

Foster Wheeler is in the process of integrating the assets into the global environmental and industrial product offerings of its Global Power Group. The company now offers environmental equipment and services to complement its steam generator products.

Gary Nedelka, Chief Executive Officer of Foster Wheeler's Global Power Group said: "With environmental legislation becoming increasingly stringent around the world, we wanted to be in a better position to address these environmental challenges for our clients."

The company can now offer design, engineering, retrofit and service of a broad range of clean air technologies for power and industrial plants including: wet and dry flue gas desulphurisation (FGD) and particulate control (fabric filters and electrostatic precipitators), acid gas control, mercury control, NOx reduction and combustion optimisation systems.

"Foster Wheeler now offers a full array of solutions to meet both tightening environmental regulations and the growing demand for energy on a global basis," said Nedelka.

Green bond to fund GDF Suez renewable expansion



Mestrallet. The bond issue will help GDF Suez address the "great energy and environmental challenges"

- Issue three times oversubscribed
- Strong demand from socially responsible investors

GDF Suez is planning to finance its ambitious development strategy in renewable energies and energy efficiency through the issue of a €2.5 billion green bond.

The group issued the bond – the largest ever dedicated to sustainable development – in May, and says that the issue was three times oversubscribed. Strong demand came from investors focused on environmental and socially responsible investing, who bought 64 per cent of the issue.

"This unusually large issue will

serve the strategic priorities and sustainable growth strategy of GDF Suez in renewables and energy efficiency in Europe and throughout the world," said CEO Gerard Mestrallet. "Projects financed by this bond issue will enable the group to address the great energy and environmental challenges we face: meeting energy needs, ensuring security of supply, combating climate change, and optimising natural resources."

Projects financed by the proceeds of this bond must meet a number of

social and environmental criteria and will follow a traceability procedure that will be audited, said GDF Suez.

GDF Suez has pledged to increase its installed renewable energy capacity by 50 per cent between 2009 and 2015, and to increase its business activity in energy efficiency in Europe by 40 per cent by 2018.

In May the company won a competitive tender in France to install two major offshore wind farms with a combined installed generating capacity of 1000 MW.

Industrialisation holds the key

With orders for several hundred of its new 6 MW direct drive wind turbine, Siemens is gearing up for serial production of the machine. The move to mass production will be crucial to lowering the cost of energy for offshore wind. **Junior Isles**



Ongoing reduction in the cost of offshore wind power is crucial to ensuring its long-term place in the energy mix as the leading low carbon energy option. Two key areas that are critical to lowering the levelised cost of energy (LCOE) are: larger, more efficient turbines produced using serial production techniques; and reduced cost of servicing.

Several manufacturers are close to commercialising wind turbines in the 6 MW range. According to Siemens, however, the first of this generation of larger machines that will be produced using serial production techniques will be its SWT-6.0-154 6 MW offshore turbine from its D6 platform – the first significant number of which will begin commercial operation this year.

Commenting on the significance of this milestone, Michael Hannibal, CEO of Offshore EMEA at Siemens Wind Power said: “Over the last decade, we have managed to take 40 per cent out of the LCOE. If we are to get below €0.10/kWh in 2020, we need to take another 40 per cent out in a slightly shorter period. The D6 will be a big contributor to us getting there.”

The D6 platform represents Siemens’ latest degree of innovation in wind turbines. The SWT-6.0-154 direct drive turbine is equipped with some of the world’s longest rotor blades – each blade is 75 m in length, giving a rotor diameter of 154 m.

At 75 m, the B75 blade used in the new rotor is the world’s largest fiberglass component cast in one piece and will also be the largest serial produced blade. It is characterised by high stability and low weight. Special aerodynamic profiles deliver optimum performance at a wide range of wind speeds.

The rotor blade is manufactured from glass fibre-reinforced epoxy resin and balsa wood using the patented IntegralBlade process. It has no seams or glued joints and no adhesive, all of which saves weight. Each blade weighs 25 tonnes, which according to Siemens is up to 20 per cent lighter than blades manufactured with traditional methods.

Overall, combining an intelligent rotor blade profile with low weight helps lower the cost of wind energy. The rotor sweeps an area of 18 600 m², the size of two-and-a-half football pitches. This large rotor swept area is essential for the annual energy yield of the turbine. Siemens calculates that one SWT-6.0-154 wind turbine can generate about 23 million kWh annually at a typical offshore site having a mean wind speed of 8.5 m/s.

The rotor is operated at variable speed, 5-10 revolutions per minute. At maximum rotational speed the blade tip moves at 80 m/s.

Although the blades are impressive, perhaps the most interesting feature of the turbine is the direct drive technology.

Henrik Stiesdal, Chief Technology Officer of the Wind Power Division within Siemens Energy Sector explained the rationale behind the machine’s development.

“It was clear that we needed a larger machine for offshore application; the fundamental reason being that all experience shows that the infrastructure costs of larger machines do not increase proportionally to the power rating. For example, building a foundation for a 6 MW turbine is not 60 per cent more expensive than building one for a 3.6 MW machine.”

He added: “We also know from on-shore projects that there are savings

when you have fewer larger machines. Fundamentally, the market was calling for a turbine that had a smaller infrastructure footprint per megawatt than our 3.6 MW turbine.”

Siemens was also aware that developing a machine with a higher power density would not be enough on its own. It knew that going further offshore into deeper water would dramatically increase the cost of servicing and component replacement.

About 15 years ago, it began looking at turbine reliability and how to reduce the potential for turbine failure. At the time, the most vulnerable part of the turbine was the gearbox. The company therefore looked at direct drive technology – the main aim being to reduce the number of moving parts in the turbine and thus the potential for failure.

Stiesdal notes that its 3.6 MW wind turbine gearbox has 13 gear wheels and 22 bearings. “The survival probability of the gearbox is the product of the survival probability of each component multiplied together. The direct drive only has one or two bearings and no gear wheels, and so puts an end to this consideration.”

He added: “But whatever your view on the reliability of geared versus direct drive, the main arguments for this technology are the weight and the scaling benefit, which is important as we move to even bigger machines.”

Replacing the gearbox, coupling, and high-speed generator with a low-speed generator eliminates two-thirds of the conventional drive-train arrangement. As a result, the number of rotating and wear-prone parts is vastly reduced.

Compared to its 4 MW platform geared machines, the direct drive turbine has 50 per cent fewer components

in the nacelle. This has a significant impact on the weight of the turbine. Previously the weight of large wind turbines had grown disproportionately compared to the increase in power rating. However, the nacelle of the SWT6.0 weighs no more than 200 t, compared with 140 t for the nacelles of Siemens’ existing 3.6-120 geared turbines and its G4 platform.

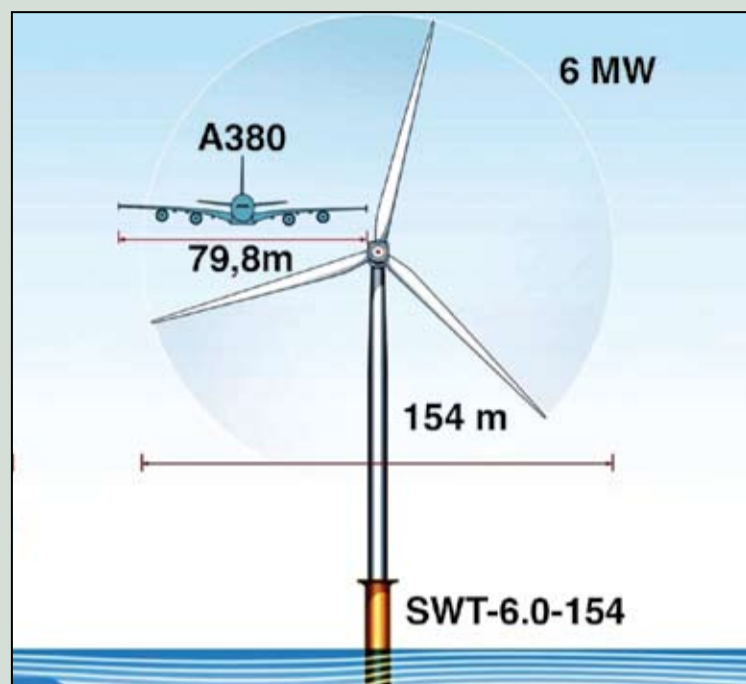
A low tower head mass offers significant cost benefits on the complete turbine structure and indeed throughout the entire value chain. It allows more turbines to be loaded onto an installation vessel for optimal utilisation and reduced logistics cost; it reduces tower and substructure requirements and allows easier installation. The lower weight also means that all types of foundations can be used, including traditional monopile foundations on larger water depths than with heavier machines.

Siemens noted that today significant time and effort is spent on designing a foundation and placing a tower on top. In the future it argues there will be no need to “call it a foundation and a tower”. Both will simply be seen as a “distance keeper” from the seabed to the nacelle.

In developing the machine, Siemens drew on past experience of how to reduce complexity in its wind turbines. “In some ways, we followed the same logic as we did for our blades. In the past, the complexity of blade manufacture presented many opportunities for error. So we took the approach of designing them in one piece with as few different types of fiberglass as possible,” said Stiesdal.

The company’s first patent application related to direct drive technology was submitted by Bonus Energy, later acquired by Siemens in May 1999.

Special Project: Supplement



The SWT-6.0-154 direct drive turbine is equipped with some of the world's longest rotor blades – each blade is 75 m in length giving a rotor diameter of 154 m

However initial studies performed in conjunction with key suppliers showed that the development of such a machine was not economically feasible.

Siemens' acquisition of Bonus in 2004 presented new possibilities and efforts were again ramped up in 2005. Working with its three main sub-suppliers, Siemens built two proof-of-concept 3.6 MW direct drive machines in 2008. But it was the serial production capability of Siemens that proved to be the turning point in the path towards making the technology economically viable.

Stiesdal explained: "While we accepted that our suppliers were more competent in, for example, manufacturing of laminates and coils for the generators, we were perhaps better at serial production of large components. For one of the suppliers we were in discussion with, we looked at the number of components they had produced of any given design and found that the average was just one-and-a-half per design over 10 years. So basically, they were always making prototypes."

"To drive costs down and be [financially] successful with a turbine model, you need to pass the 1000 units manufacturing threshold. You are only able to make money when you are producing machines where the volumes run into the thousands."

This "automotive" approach means components have to be designed for mass manufacturing and some of the key challenges in making large electrical machines eliminated.

One of the main challenges to mass production of large wind turbines is having enough space set aside in the factory for initial assembly of the electrical stator of the machine.

"Typically," said Stiesdal, "stators of this size need factory floor spots of 10 m x 10 m minimum. It can take weeks to laminate thousands of pieces

of iron and insert copper winding coils. We took a key radical step in early 2008 when we decided to segment the stator. This allowed us to cut assembly time from weeks to just 8 hours. It was a quantum leap in terms of reducing the required factory floor space and investment."

The prospects of true industrialisation and serial production were also what enabled Siemens to enter into a large framework agreement with Dong Energy in 2009 for the supply of its 3.6 MW turbine. Covering six projects and more than 500 turbines, this was essentially the start of industrialisation.

Hannibal commented: "This was when the industry and the customer could start looking at multiple projects as one. It avoided the situation experienced with one-offs, where you have to mobilise and de-mobilise, wait a period, and then do the same again."

It set the stage for building a larger offshore direct drive machine more economically. The project to deliver a 6 MW turbine was officially kicked off in late 2009 with the Product Requirement Specification Document specifying things like the turbine size and rating, as well as the serviceability and product lifetime requirements. This document was used to produce a Product Design Specification (PDS) that determines how the product requirements will be achieved.

With the PDS completed in the spring of 2010, it then took about one year to complete the first prototype turbine in May 2011. This was installed at the Høvsøre test site in Denmark.

Due to height restrictions, a 120 m rotor was used on the prototype. Further, as it was a new machine using new direct drive technology, the use of a known rotor size reduced the number of unknowns during testing.

"The main purpose was to test the direct drive concept in the 6 MW size

range. Therefore the prototype and pilot series machines had the 120 m rotor used in the 3.6 MW turbine," said Stiesdal.

This onshore testing of the technology was sufficient to give Dong enough confidence to enter into another framework agreement with Siemens. In July 2012 Siemens agreed to supply 300 SWT-6.0-154 machines with a total capacity of 1800 MW for installation at wind farms off the British coast between 2014 and 2017.

Siemens has since started testing of the turbine with the new 154 m rotor. The first prototype was installed at a new national test centre in Østerild, Denmark, and began operation in September 2012. Testing of a second 154 m prototype is also ongoing at SSE's test facility in Hunterston, Scotland.

The first offshore tests of the technology took place using two SWT-6.0 prototypes installed in the British offshore wind power plant, Gunfleet Sands. These machines utilised the 120 m rotor.

According to Siemens, the turbines at Gunfleet Sands have run well, providing operational data as well as a huge amount of information on the installation phase, demonstrating that the machines are easy to install.

Serial production is now under way with the 35 SWT-6.0-154 units for Dong Energy's Westernmost Rough project, again off the British coast. This will be the start of a number of units that will be delivered to various projects. Hannibal noted that more than 500 machines are fully committed, with "some hundreds" awaiting final investment decisions.

These units will be produced at new facilities to be built in the Hull area of Yorkshire, in the north of England.

Although the challenge is a big one, Siemens says it is not greater than expected.

"The fundamental issue," said Stiesdal, "is the size of the components. The suppliers are working at the boundary of their competence and experience. The main thing here is supplier assurances on delivery and quality. But this is something we have seen many times in this industry; it was the same with the 2 MW machine and then the 3.6 MW. Someone is the first to serialise a big machine and then there's a big learning curve for all involved."

He added: "We know this perfectly well from the introduction of our new larger blades." Siemens produced the first B75 blades in 2012 and there are a significant number in operation in prototypes.

"Now we are taking the step from doing them under laboratory conditions, where we have a lot of time, to what seems to the blade factory like an extremely small number of hours allowed for each blade. Basically it is about weeding out all of the waiting time. We have people doing this in Aalborg now and we are doing well relative to the learning curve," said Stiesdal.

According to Siemens, a major benefit of the new machine will be easier servicing. The absence of a

conventional drive-train and gearbox in the nacelle allows much more working space for service engineers.

Clare Causier, New Product Introduction Co-ordinator for Service Renewables UK and Ireland noted: "Inside the nacelle has more of a feel of a factory floor environment. There are two floors within the nacelle, including a flat floor area; it's a lot more ergonomically designed. It makes tasks on things like hydraulics and replacing consumables a lot easier to do in a high quality repeatable way."

With the main bearing being 4 m in diameter, access platforms are provided to enable technicians to reach some of the bolts connecting the hub to the nacelle, and also to service the generator.

Direct drive technology has enabled many components to be moved from the bottom of the turbine into the nacelle. This means the nacelle can be pre-commissioned onshore before being brought out to sea.

This will be a big contributor in reducing the number of hours that installers and maintenance engineers need to spend offshore.

Causier commented: "One of the

SWT-6.0-154 key technical data

IEC Class	IA
Nominal power (kW)	6000
Hub height	Site specific
Power regulation	Pitch regulated, variable speed
Tower head mass (t)	360
Rotor:	
Rotor diameter (m)	154
Blade length (m)	75
Swept area (m ²)	18 600
Speed range (r/min)	5-11
Operational data:	
Cut-in wind speed (m/s)	3-5
Wind speed for nominal power (m/s)	12-14
Cut-out wind speed (m/s)	25
Maximum 3 sec gust (m/s)	70 (IEC version)

main differences between onshore and offshore [servicing] is that you really don't want to have to go offshore. So the turbine is designed to reduce the number of visits between scheduled service intervals."

As it is still a new machine, engineers are basing servicing on an annual schedule. On a typical visit, technicians focus on critical components i.e. tracking and ensuring safety-critical systems are functional. Consumables such as grease in the main bearing are checked and changed along with filters in electrical cabinets. There are also visual inspections of bolts and connections. Bolts are tested to ensure they are at the correct tension.

Scheduled maintenance activities will be combined with 24/7 monitoring. As the turbine is fitted with many sensors, these can provide early warning alarms. Technical support teams either in the UK or Denmark constantly check these alarms. By analysing high frequency data, they can establish what corrective action

Siemens has taken a stake in A2SEA to further promote the industrialisation of offshore logistics. A2SEA's new installation vessel, the SEA INSTALLER is purpose-built for transporting and installing large wind turbines

Special Project Supplement



The first offshore tests of the technology took place using two SWT-6.0 prototypes at Gunfleet Sands

might be needed either immediately or at the next scheduled maintenance.

“Remote monitoring is absolutely critical,” said Causier. “If there is an issue, it allows engineers to go out with the correct parts and the correct tooling to hopefully remedy the problem on the first visit. The aim is to minimise downtime and the time in which the technician is out in that high-risk ocean environment. When turbines are stopped it means loss of earnings for our customer.”

Siemens says constant data collection from monitoring will enable more predictive/condition-based maintenance in the future and sees developing its capabilities in this area as very important.

“There are a number of activities ongoing in the background,” said Causier. “Taking the gearbox out removes the number of high speed rotational components. But vibration monitoring can also detect faults on the blades or in the generator. Vibration monitoring for condition-based maintenance and diagnostics is already used on the drive-train of our geared machines and this will be continued on our direct drive machines.”

Industrialising the servicing process and ensuring it works in an optimum way is also important in reducing the running costs and therefore lowering the LCOE.

Servicing will therefore also be an integral part of the new facility in Yorkshire. There will be a logistics centre at the Hull site for housing spare parts and shipping them out to the North Sea and network of centres throughout the UK. With this centre the number of employees of Siemens Energy in the UK rises to about 900 people.

Causier added: “Servicing and maintaining a wind turbine is not just about the turbine itself. It’s also about the whole logistics chain – getting out there, organising the helicopters – and

making sure everything is lined up so you have the right person, in the right place, at the right time.”

In addition to the Hull investment, Siemens is also investing in a Customer Support Centre (CSC) in the UK, which it says will bring a lot of capabilities into one place, and optimise them for working in the offshore environment.

“It’s about all the associated services you need to operate and maintain offshore wind farms to a high standard in order to optimise the energy produced,” said Causier.

Siemens will be investing a total of £160 million (\$256 million) in the new wind turbine blade production, final nacelle assembly, installation and service facilities in the Humber area.

The revised plan announced in March this year will be spread across two sites comprising the previously announced Green Port Hull project construction, assembly and service facility and a new rotor blade manufacturing facility at a new development site near Paull, in East Riding.

Siemens’ partner in the project is Associated British Ports (ABP), which is investing £150 million in the harbour facility. ABP is one of the UK’s leading port operators.

The site near Paull, which will be dedicated to building the 75 m blades, will be connected to the dockside by a new 5 km link road to be built on ABP’s land. At the dockside there will be a final assembly facility for the nacelles, as well as an installation area for laydown of all final components before loading on to the shipping vessel. The service and logistics centre will be located at an adjacent site.

ABP’s investment in the Green Port Hull development will cover work on the dockside to bring it up to scratch and building of the link road. The contract between Siemens and ABP will run for a minimum of 15 years.

Separate planning applications for the facilities at Alexandra Dock, the blade factory near Paull and the link road will be submitted during 2014. If applications go according to expectations, consent to start building is expected by the end of this summer. Construction at Alexandra Dock would then start this autumn and building of the factory from 2015, with the facility expected to be operational in 2017.

The combined investments of £310 million will create up to 1000 jobs directly, with additional jobs during construction and indirectly in the supply chain. A smaller number of jobs will also be created this year at the logistics centre. Recruitment for the factory will start during the spring of next year.

Matthew Knight, Director of Strategy and Government Affairs at Siemens Energy commented: “The Alexandra Dock operation will employ about 450 people. At the Paull site, there will be about another 550 people. These will be full-time long-term jobs. The jobs created during construction, will peak at about 350.”

In preparation for these jobs, Siemens has been talking with local educational organisations such as schools

and colleges and the local University. “We are keen to invest locally in skills and training,” said Knight.

Notably, Siemens was involved in the launch of the Norstec Academy last month. Norstec is a network that brings together key players in the offshore renewables sector who recognise the enormous opportunities offered by the northern seas’ offshore wind and marine potential. The Academy is focused on engaging and informing the next generation of offshore wind employees. This skills initiative is aimed at students in colleges of further education and undergraduates.

As the first real investment spurred by Round 3, the announcement of the new facilities is important for both Siemens and the UK offshore programme. This was underlined by the attendance of British Prime Minister David Cameron at the event marking the announcement.

Knight believes that the investment makes it politically possible to have the size of industry that is needed to bring down the cost of offshore wind.

He observed: “It’s a really significant investment in its own right but it is also being seen as a turning point for the whole industry. Over the last years, the question of whether Siemens would come to Hull or not has been seen as the touchstone of whether the offshore industry is really going to work in the UK.”

Knight believes that the impact goes beyond the investment and job creation. “The mood around offshore wind has really changed since March 25th. It is having an effect on how other companies view the industry. People, including competitors, customers and those in the supply chain have thanked us for making the investment.

“It is also affecting how politicians view the industry. We are now hearing them subtly talk differently about offshore wind. Before, the language was about potential; now it’s much more about a growing industry. The dialogue is now about something that is happening, which we don’t want to stop, as opposed to something that would be nice to have.”

Arguably, the UK needs offshore wind more than any other country in Europe. With the EU moving to a low carbon economy, each country will need to make the most of its natural resources to achieve its target.

“The best opportunity we have for a competitive large-scale resource of renewable energy is offshore wind,” noted Knight. “We need offshore wind to succeed more than other countries do.”

The UK is by far potentially the largest market for offshore wind in Europe. In addition to the 3.6 GW of capacity already installed, a further 3.8 GW is either in construction or has planning approval, and a further 7.8 GW is in the planning system. Industry projections see a total of around 6 GW of capacity installed by 2016 and around 14 GW installed by 2020.

Despite the impressive growth, however, in recent years it has not been all plain sailing. The changeover in government support mechanisms

from Renewable Obligation Certificates to Contracts for Difference (CfD) created a period of uncertainty.

“For us, the UK is the number one market, said Hannibal. “It went into a bit of a turbulent period when the change in support mechanism was first announced and a lot of projects were delayed or postponed. But the CfD scheme will make non-balance sheet financing easier and so attract non-utility investors such as pension funds and other industry players. Now the market is really gaining traction again.”

There was certainly evidence of this with the announcement in May that eight projects were moving ahead under the Final Investment Decision (FID-ER) Enabling for Renewables process.

Siemens sees the UK government’s commitment to wind as extremely positive as it provides predictability for the years to come.

“Knowing what will happen is very important. If you have a project that has too many variables, i.e. it depends on a final investment decision from the board as well as the market rules, then the outcome starts to become a bit too uncertain,” said Hannibal.

Siemens is also upbeat about the German market, in spite of moves to reduce renewable subsidies. Looking out to 2020, the company has a good backlog of projects concentrated around the UK and Germany.

Hannibal commented: “We have a busy schedule with our German projects, with seven or eight projects in the backlog to be executed in the coming years. Installation activities in the UK will be significantly down in 2015 due to the transition and the uncertain period before announcing the changes in support mechanisms. But it will pick up again in 2016.”

Beyond 2020, Siemens sees markets such as France, Belgium and the Netherlands becoming more important. Outside Europe, it is the preferred supplier for the Cape Wind project in the US and is looking at how other projects could develop there. Meanwhile, it is about to erect its first offshore wind farm in China and more are in the pipeline.

Hannibal noted: “We are also looking at Japan, Korea, Taiwan and other Asian markets. These projects will start to come in just before 2020 but there will be a number installed after 2020.”

With a €10 billion order backlog and more than 50 per cent of it related to offshore wind, Siemens believes in the long term future of the industry.

Hannibal concluded: “If the industry can get the cost of offshore wind down, and we believe it can, and you start comparing it with coal and nuclear on an apples-to-apples basis – looking at the real LCOE taking into account the hidden subsidies for coal and nuclear – people will change their mind from ‘we can’t afford offshore’ to ‘we can’t afford not to do offshore’. When you consider the social cost of electricity from offshore – the creation of jobs, long-term value chains and a green economy – it creates so much more social value.”



SIEMENS



The Siemens D6 platform

Turbina Sapiens in its natural habitat.

Siemens' offshore direct drive wind turbine with 6.0-MW rated power is a new breed of wind turbine. It is the latest evolution in the Siemens D6 platform and features the world's first 154-meter rotor.

The 'brains' are housed in the advanced diagnostics system that provides comprehensive real-time performance data and service requirements. It also keeps track of its lifetime and overall asset condition. It has 50% fewer moving parts than a comparable geared machine and a towerhead mass of less than 360 tons. The 6.0-MW

drives project profitability through optimized infrastructure, installation and service. Such a creature of lean and simple beauty could only be borne of Siemens.

Drawing on over 30 years of experience in wind power and a global network of highly skilled employees, Siemens has proven itself to be a trustworthy and reliable business partner. As the world looks for energy solutions, if anyone has the answers, then Siemens does.

[siemens.com/wind](https://www.siemens.com/wind)

10 | Tenders, Bids & Contracts

Americas

Vestas supplies Maine wind project

Vestas has received an order for the supply of wind turbines for the 148 MW Oakfield project in Maine, USA.

The wind turbine firm will supply 48 of its V112-3.0 MW wind turbine units to First Wind, which is developing the Oakfield project. The order is a call-off on the master supply agreement (MSA) announced in December 2013 for multiple US projects, the potential of which totals 718 MW.

The Oakfield supply agreement also includes a 10-year active output management (AOM) 5000 service agreement, which is an energy-based availability guarantee. The project is the fourth that Vestas and First Wind have carried out together.

Aneel selects Abengoa

Brazil's Electricity Regulatory Agency (Aneel) has chosen Abengoa to design and build two new transmission lines.

The first concession relates to a 240 km transmission line from Oriximina-Juruti and Juruti-Parintins in the state of Para as well as construction of four substations in the municipalities of Oriximina, Juruti, Parintins and Jurupari. The second concession includes the 137 km Parauapebas-Integradora Sossego, Integradora Sossego-Xinguara II transmission line and three substations.

The concessions are worth a combined €381 million. The two lines are expected to be commissioned in 2017.

Siemens wins 97 MW Peru order

Cobra Energia has awarded Siemens Energy another order to expand its onshore wind power fleet in Peru by 97 MW.

The Tres Hermanas wind power plant order includes a combination of 25 direct drive SWT-3.0-108 wind turbines and eight geared SWT-2.3-108 units. The contract also includes six years of service and maintenance.

The project is expected to be commissioned in July 2015.

Asia-Pacific

Siemens-MMC wins Pengerang EPC

Petronas subsidiary Pengerang Power Sdn Bhd has awarded the engineering, procurement, construction and commissioning (EPCC) contract for its Pengerang cogeneration plant project in Johor to a consortium of Siemens AG, Siemens Malaysia and MMC Engineering Services Sdn Bhd.

Petronas said the contract requires the consortium to undertake the design, engineering, procurement, supply, manufacturing, construction, installation, development, testing and commissioning works and warranty for the project. "The plant's first cogeneration unit is expected to be commercially operational by mid-2017," said Petronas in a statement.

It said the plant will be one of the six associated facilities to be developed within Petronas' Pengerang Integrated Complex (PIC) project. Once completed, it will produce 1220 MW of power and provide reliable and continuous supply of steam of up to 1480 tonnes per hour to PIC.

Gamesa furthers China strategy

Gamesa says it has achieved another milestone in its Chinese sales strategy, signing a contract with CGN Wind Energy, a subsidiary of China's

General Nuclear Power Group, for the supply of 100 MW to a wind farm in Yunnan province, southeast China.

Gamesa will supply and install 50 of its G97-2.0 MW wind turbines at the high altitude Yangchajie wind complex. The two firms have also agreed an option for the supply of another 100 MW during a second phase of the project in 2015.

"This agreement marks a very important step in Gamesa's sales and product strategy in China, where we recently announced another two contracts, one for Fujian for 48 MW and one for CGN for 49.3 MW," said José Antonio Miranda, Gamesa's CEO in China.

Orion seals generator suppliers

Orion Group has signed two separate agreements worth \$191 million with GE of the USA and Doosan of South Korea for supply of steam and boiler turbine generators for its 660 MW coal-based power plant in Munshiganj, Bangladesh.

GE will provide the steam turbine generator worth \$66 million, while Doosan the boiler turbine generator worth \$125 million for Orion Power Dhaka Ltd.

Orion is currently operating 300 MW heavy fuel oil-based power plants. The company is also implementing two 660 MW coal-based private power plants in Dhaka and Khulna.

Europe

Westinghouse chosen for Vattenfall reactors

Vattenfall Nuclear Fuel AB has selected Westinghouse to provide replacement nuclear fuel deliveries and related engineering services for three reactors in Sweden.

Under the contract Westinghouse will carry out yearly deliveries for fuel to Forsmark, Ringhals 3 and Ringhals 4 between 2016 and 2019. Westinghouse will produce the fuel at its facility in Västerås, Sweden.

Westinghouse has been one of the main fuel suppliers to the Forsmark and Ringhals nuclear power plants since 1973 and has delivered nearly 12 000 fuel assemblies to the plants.

Valmet wins Hungary order

Valmet will supply a complete boiler plant to Hamburger Hungaria Power in Dunaujvaros, Hungary.

The new power plant will produce electricity and steam for Hamburger Hungaria's containerboard mill that operates two paper machines. It will replace the existing gas-fired boiler plant that produces steam only, and enable Hamburger Hungaria Power to use a wide range of solid fuels such as biomass, coal as well as containerboard rejects and sludge in energy production.

Valmet's delivery will include a complete boiler plant including a Cymic boiler based on circulating fluidised bed (CFB) technology with flue gas cleaning. The boiler will have a capacity of 158 MW of steam at 113 bar, 520°C. The power plant will produce 42 MW of electricity.

The new boiler plant will go on stream by the end of 2015.

Valmet has also recently won orders to supply boilers to Raahen Voima in Raahen, Finland, and ArcelorMittal Energy Ostrava s.r.o. in the Czech Republic.

Nordex progress in France

Nordex has received its first order for its N117/2400 wind turbine in France.

Project developer VSB Energies Nouvelles has placed an order for seven of the 2.4 MW machines for installation in the Lazenay wind farm in central France.

Work on the project is expected to start in the second half of 2014 and be completed in early 2015. Nordex and VSB are also planning to execute other wind farm projects together in the future.

Tysso II orders Alstom controls

Alstom has signed a contract with Statkraft for the supply of new control systems and balance of plant equipment for the Tysso II hydropower plant in Skjeggedal, southwest Norway.

The contract includes the supply, installation and commissioning of control systems, station transformers, local distribution systems, circuit breakers and 72 kV cabling equipment that will secure a more reliable operation of the Tysso II power plant.

Work on unit 1 at the plant will be completed in 2016, with unit 2 following a year later.

Gemini moves to construction phase

The developers of the 600 MW Gemini offshore wind farm in the North Sea have signed all the construction, operation and financing contracts.

Northland Power Inc., Siemens Financial Services, Van Oord and HVC say that their focus has now shifted to the construction phase of the project, which will consist of 150 Siemens 4 MW turbines erected in the Dutch North Sea, 85 km from the coast of Groningen.

Gemini will cost nearly €3 billion to build, 70 per cent of which will be project financed, making it the largest ever project financed offshore wind farm. Siemens has signed a 15-year service and maintenance agreement with the project partners.

The European Investment Bank (EIB) has agreed to provide €587 million of financing for Gemini. Other financiers include PKA and a consortium of international commercial banks.

UK Power Networks upgrades HV circuits

UK Power Networks is upgrading three vital high voltage electricity circuits in the south of England with Nexans' innovative XLPE cables.

The new XLPE (cross-linked polyethylene) insulated pipe-type cables are replacing 132 kV gas cable circuits that are due for renewal. The compact design of the cable means that they can be drawn into existing steel pipes via a series of jointing bays, minimising road-digging and disruption for local residents.

The new pipe-type cables are ideal for high-voltage, underground systems because they can handle conductor temperatures of up to 90°C, need no fluid-pressure system and require no maintenance.

The first new circuit, running a distance of around 12 km between Steyning and Worthing on the south coast of England, has already been commissioned.

International

Algeria boosts substation capacity

Comptoir Algérien du Matériel Electrique et Gazier (CAMEG) has placed an order with Avantha Group Company CG for the supply and installation of 60 kV instrument transformers at substations across Algeria.

CG will provide indigenously built high voltage equipment worth

€4 million, including 800 x 60 kV current transformers, 800 x 60 kV capacitive voltage transformers, and 250 x 60 kV inductive voltage transformers. The project commenced in April 2014 and will be completed by October 2015.

OPWP invites bids

Oman Power and Water Procurement Company (OPWP) has issued a Request for Proposals (RfP) to six international companies inviting them to participate in a competitive process for a licence to build a new Independent Power Project (IPP) in Salalah.

The new gas-fired plant, dubbed Salalah2 IPP, will have an installed capacity of 300-400 MW and will be located next to an existing 273 MW power plant on the Raysut site owned and operated by Dhofar Generating Company.

According to officials, RfPs have gone out to six major developers that have been prequalified by OPWP to participate in the competitive tender. The list comprises European energy heavyweight EDF International; Japanese conglomerates Mitsui & Co, Marubeni Corporation and Sojitz Corporation; Korea Electric (Kepco) of South Korea, and the International Company for Power and Water (ACWA).

The successful bidder will secure a 20-year licence to develop, finance, design, engineer, construct, own, operate and maintain a gas-fired power station at the Raysut site, and will also acquire the assets of Dhofar Generating Company.

Salalah2 IPP is slated for commercial operation during 2018.

CG and Iberdrola team up

Avantha Group Company CG has sealed a deal with Iberdrola Ingenieria y Construccion to supply high voltage equipment for substations being constructed in the Greater Nairobi Metropolitan Area, Kenya.

The order, worth \$15 million, involves the supply of six 200 MVA, 220/66 kV high voltage power transformers, circuit breakers, instrument transformers and lightning arresters for the Nairobi Ring project, which Iberdrola is supervising.

The CG power equipment will be installed in the new 220 kV substations at Isinya, Suswa, Ngong, Athi River and Koma Rock. The equipment will also feature in the existing Dandora substation, which is going through expansion.

The project is scheduled for completion by the end of 2014.

The Nairobi Ring project will help meet Kenya's rising electricity demand, projected to grow at around 14 per cent per year, from 1205 MW last year to 15 065 MW by the year 2030. The KSh4.9 billion (\$58 million) substation project is financed by Agence Francaise de Development (AFD) and the government of Kenya.

Yokogawa wins Jeddah South order

Hyundai Heavy Industries Co. Ltd. has placed an order with Yokogawa Electric Corporation to supply control systems, safety instrumented systems, analysis systems, and other products for Stage 1 of the Jeddah South supercritical oil-fired thermal power plant project in Saudi Arabia.

Jeddah South will be Saudi Arabia's first supercritical thermal power plant, and is being built by a state-owned enterprise, the Saudi Electricity Company. Stage 1 of this project involves the construction of four 723 MW units producing a total of 2892 MW.

Unit 1 is scheduled to start operation in 2017.



Oil

Oil market remains stable despite political turmoil

- Political tensions threaten disruptions
- Saudi Arabia and Opec ready to fill gap

David Gregory

Crude oil prices hit the high side in mid-March amid continuing political turmoil in Libya and Ukraine. West Texas Intermediate (WTI) moved in the \$102-104/b range during the third week of May while Brent sold at \$109-110/b.

The continuing, and seemingly growing, political violence in Libya continues to keep about 1.2 million b/d off the market.

With oil supplies stable in spite of supply disruptions from Opec members Libya and Iraq, Saudi Arabia's Minister of Petroleum Ali Naimi reassured consumers last month that his country, with a production capacity of more than 12 million b/d, would increase output should the need arise.

As political violence in eastern Ukraine showed its teeth in mid-March, the US and EU continue a close watch on Ukraine. Speaking in Seoul last month, Naimi said that if the Ukraine crisis brings about a disruption in Russia crude oil exports,

Saudi Arabia and Opec would step in to fill the gap.

Media reports say the European Union is examining ways that EU members can reduce their dependence on Russian oil and gas as part of a European energy security strategy. The group is to discuss the issue during a gathering of EU heads of state in late June. Concern has been expressed about Russian ownership of European refineries.

Crude oil supplies from Opec rose during April by 405,000 b/d over March to average 29.9 million b/d, according to the International Energy Agency (IEA). The Paris-based agency said in its May Oil Market Report that the call on Opec crude during the second of 2014 had increased by 140,000 bpd to 30.7 million b/d. It forecast the average demand for Opec crude during 2014 at 30.1 million b/d.

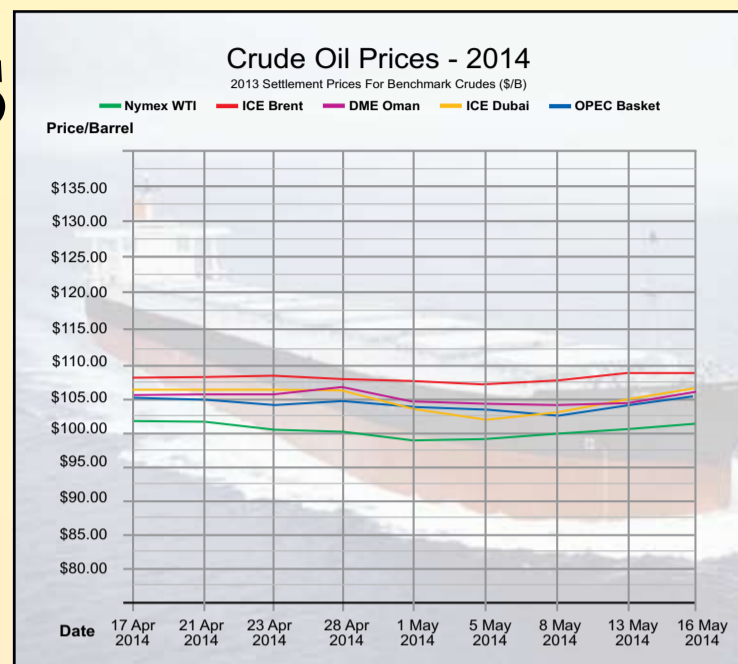
Opec's next ministerial meeting will take place in June and members are expected to rollover its 30 million b/d production target for another six

months. With the market stable, Opec members see little reason to make adjustments. In its latest monthly oil report, Opec said it the combined production from Opec and other producers should bring a "fairly balanced market this year."

However, Opec may in the future be faced with having to adjust its production allocations when and if Libya crude production comes back into play and if international sanctions are ever lifted from Iran. The return of those two countries to a state of normal could put another 2 million b/d on the market, plus there is growing oil production in Iraq that remains restrained because of inadequate export infrastructure.

Iraq produced 3.34 million b/d in April according to the IEA, but the country has targeted a production level of 4.5 million b/d by the end of the year and intends to boost output to 9 million b/d by 2020.

Global crude oil supplies increased by 700,000 b/d during April to 92.1



million b/d, the IEA report said, noting that Opec was responsible for more than half of the increase. Non-Opec output rose by 285,000 b/d, most of which came from the US, the UK and China.

Political, technical and operations issues continue to weigh on non-Opec supply, the IEA said. The 2014 production outlook for South Sudan and Colombia were downgraded because of domestic violence, pipeline attacks and issues with local communities, it said. Kazakhstan's and Canada's production forecasts were also downgraded because of technical problems and heavy maintenance.

The IEA forecast crude oil demand for 2014 at 92.8 million b/d.

Meanwhile, the burgeoning increase in shale oil production in the US has policy makers there debating whether to lift the government's ban of oil ex-

ports. Proponents argued that US refineries are geared to processing heavier oil than the light crude that shale deposits are producing. There is also the argument that US supplies could be used as an alternative to Russian crude, particularly in Europe.

The US Energy Information Administration (EIA) said in its May report that total US crude production during the month of April averaged 8.3 million b/d, the high monthly average since March 1988.

US total crude oil production averaged 7.4 million b/d in 2013 and is expected to rise to 8.5 million b/d in 2014 and to 9.2 million b/d in 2015, the EIA said, adding that the 2015 forecast represents the highest annual average level of production since 1972.

Gas

Fracking may have negative impact on energy exporters

The 'fracking' revolution – the use of hydraulic fracturing in extracting gas and oil from tight geological formations – promises numerous changes in international energy markets. It will be a boon for some countries and result in losses for others, according to a new study released by a UK think-tank.

Mark Goetz

The economic impact that the increasing appearance in global markets of shale gas and oil could have on developing countries is the subject of a recent study carried out by the UK's Overseas Development Institute (ODI) entitled: 'The Development Implications of the Fracking Revolution'.

"We find significant impacts on some developing country gas and oil exporting countries from the changes in the US energy market – and would expect these to be considerably amplified if, as we expect, the use of fracking technologies expands rapidly to China," the report said, adding that geopolitical implications could also occur.

Energy markets have already changed, the report said, noting that US oil imports from Africa have de-

clined and that US gas imports have collapsed over the last 5-10 years, as tight oil and shale gas production in the US have increased.

A review of the data suggests that US imports of oil and gas may have been 50 per cent less than would otherwise have been the case in 2013. It can also be expected that Chinese imports of gas to be some 30-40 per cent lower in 2020 than they would have been if there were no fracking in China, it said.

Currently, China produces very little shale gas, but output is expected to reach 60-100 billion cubic metres (bcm) by 2020, compared with the estimated 250 bcm of gas imports that China is forecast to receive in 2020.

"If China can establish shale gas production successfully, as well as relieving pressure on other energy

sources it will reduce dependence on imported energy," the report said, noting that some of China's fuel imports come from politically unstable and unreliable sources such as Sudan, Iran and Venezuela.

The report states that US shale gas production rose by \$16 billion between 2007-12. This development led to reduced imports from developing countries it said. "Assuming [US] domestic production of shale gas in the US displaces imports, by 2012 developing countries were exporting 50 per cent less gas than they would otherwise have done to the US market. This implies that developing countries have lost around \$1.5 billion in gas export revenue due to US shale production," the report said.

Shale oil production in the US has increased by 4 million b/d during the 2007-12 period, leading the think tank

to assume that developing countries export around 50 per cent less oil to the US by 2012 than they would have done otherwise. "In the case of suppliers of US oil and related products, a much larger number of countries are exposed to potential trade shock induced by fracking than in the case of gas," the report said, adding that the cost of lost exports to the US could amount to \$32 billion. Data shows that US imports of crude oil from Opec members Nigeria, Algeria and Angola have declined in recent years.

Fracking will have a geopolitical impact on the global market that will provide benefits to the US and China in terms of greater energy independence, the report said. The implications are seen as strengthening the US, particularly in the short-term; reducing China's energy dependence over the medium term; generating a significant

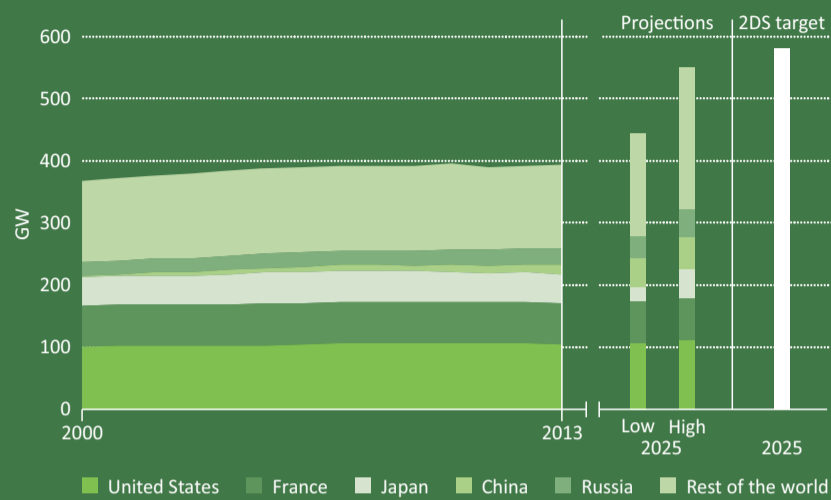
global economic stimulus; decreasing Russia's influence in the short-term (offset in the long term by Russia's own resources); and possibly destabilising major Gulf states and reducing US interest in that area.

"If the US gradually moves towards energy independence in the next two or three decades this could spark a shift of Middle East and North African to Asia. This possibility is already leading to anxiety in some of the Arab capitals, the report said.

Russia is most likely to suffer some of the largest negative consequences of shale gas exploration, the report said. As 40 per cent of its revenues come of oil and gas exports, "any price reduction would lead to serious concerns about government revenue and economic policy at a time when oil production in Russia has begun to plateau," according to the report.

Tracking clean energy progress: nuclear

1.9 Installed gross nuclear capacity



Recent developments

Japan confirmed that nuclear energy will be part of its energy mix, though the level is yet unknown

Korea lowered its target for the share of nuclear capacity to 29% by 2035

The UK government offered guaranteed price levels over 35 years to a new nuclear facility

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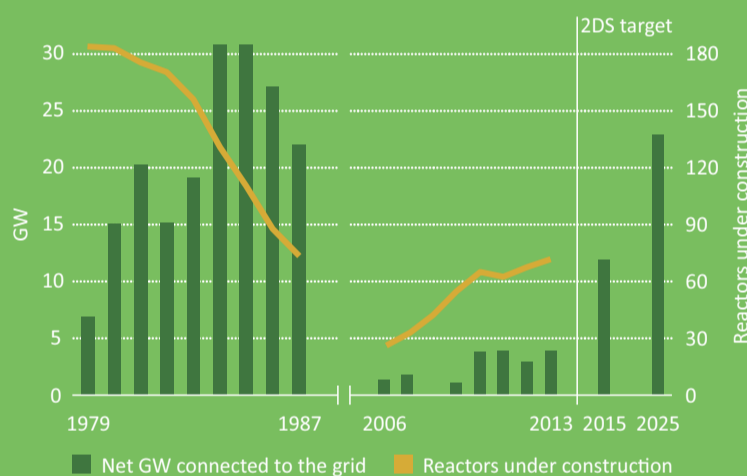
23

GW REQUIRED CAPACITY ADDITIONS YEARLY FROM 2020 TO 2030

30

GW HISTORIC HIGH IN CAPACITY ADDITIONS

1.10 Capacity additions



1.11 Construction span for Gen II and Gen III reactors



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Shale gas is not the saviour of UK energy

In spite of the government's efforts to streamline procedures and remove barriers, developing the UK's shale gas resources is not going to be a straightforward or quick process, argue **Angus Evers** and **Rinku Bhadoria**

Barely a week goes past without Britain's government making a new announcement about the potential for shale gas exploration and production in the UK and promising to speed up the pace of development.

On April 24, 2014, Minister of State for Energy Michael Fallon MP announced that "It's time to get ready for shale" and stated that the govern-

ment was fully committed to ensuring the UK not only benefits from the energy security shale gas could provide, but also maximising the economic benefit across the country. Just under a year before that, on May 15, 2013, Fallon announced that the government was creating a framework to "accelerate" shale gas development.

Also on April 24, 2014, the trade body United Kingdom Onshore Operators Group published a report written by EY titled 'Getting ready for UK shale gas'. The report estimated that the creation of a new onshore supply chain market for the equipment, services and skills required for the development of a shale gas industry in the UK could be worth up to £33 billion (\$53 billion) by 2032, and create over 64 000 jobs. Such investment could bring up to 4000 wells into production.

With so much political rhetoric around developing the UK's shale gas resources, it is surprising that there has been so little activity in the sector. Since the lifting of a temporary moratorium on hydraulic fracturing in the UK in December 2012, not a single shale gas well has been hydraulically fractured. Despite the government's good intentions, there remain a number of regulatory hurdles that need to be overcome before a shale gas industry in the UK can really start to develop.

Unlike in the United States, where onshore hydrocarbon resources are owned by private landowners, in the UK all such resources are appropriated by the government under the Petroleum Act 1998. It is illegal to "search and bore for and get petroleum" without a Petroleum Exploration and Development Licence issued by the Department of Energy and Climate Change (DECC).

Licences are issued periodically in rounds, the last of which took place as long ago as 2008. However, the government intends to hold a further round later this year, which is expected to attract a great deal of interest. In December 2013 DECC published an Environmental Report of the Strategic Environmental Assessment carried out for this licensing round, which covered approximately 40 per cent of the UK.

In addition to a Petroleum Exploration and Development Licence, a range of other regulatory approvals are required to explore for and produce shale gas in the UK. Arguably the most significant approval – and potentially the most difficult to obtain – is planning permission.

Unlike applications for other types of key infrastructure developments, which are determined centrally by the Planning Inspectorate under the Nationally Significant Infrastructure Projects regime contained in the Planning Act 2008, planning applications for shale gas developments are determined by local planning authorities. This means that they are considered by local councillors, who may be sensitive to local residents' concerns and objections to shale gas development in their local area. Last year's protests in the West Sussex village of Balcombe are a stark reminder of the strength of local opposition

to some shale gas developments.

A further issue with the planning process for shale gas development has been the need to notify surface landowners of applications where horizontal wells are to be drilled under their land. However, in England the government has taken action to streamline this process for developers by removing that requirement through an amendment to the Town and Country Planning (Development Management Procedure) (England) Order 2010. Now, only landowners on whose land surface development will take place need to be notified of planning applications.

A similar issue relating to surface landowners is that of trespass. Technically, any shale gas developer drilling under a surface landowner's land requires that landowner's consent or the developer will be committing a trespass, in which case the landowner can seek an injunction or damages from the developer.

There is a procedure in the Petroleum Act 1998 for compulsorily obtaining sub-soil access rights, but the procedure can take over a year. The government is therefore believed to be looking at removing landowners' rights to stop trespass by onshore drilling for oil and gas under their land. A further announcement is expected in the Queen's Speech on June 4, 2014.

the report concludes that there is geological uncertainty around the reserves of shale gas that are present. Moreover, the report emphasises that this estimate does not reflect the gas that it might be possible to extract, which is unknown but rather it will depend on "the economic, geological and social factors that will prevail at each operation".

Given the uncertainty around the amount of viable reserves and associated timing implications, it is clear that shale gas cannot provide a short-term fix to the energy trilemma of affordability, security of supply and decarbonisation currently faced by the UK.

With 20 per cent of existing electricity generating capacity – particularly ageing coal and nuclear generating plants – due to come off-line in the next decade and in light of the UK's ambitious carbon emissions reduction targets, it is clear that more urgent measures are required to meet the UK's rising energy demand.

To this end, the recently passed Energy Act 2013 has paved the way for the implementation of the government's major Electricity Market Reform programme across the UK, which, inter alia, is intended to encourage investment in low carbon technologies including wind, biomass and nuclear power.

Another question that has divided

With so much political rhetoric around developing the UK's shale gas resources, it is surprising that there has been so little activity in the sector

In addition to planning permission and landowners' consents, a number of environmental permits are required for shale gas exploration and production. Such permits are likely to include an environmental permit for managing flow-back fluid and waste gases from hydraulic fracturing. If the former contains naturally occurring radioactive materials, then it will be classified as radioactive waste, which means that the developer will also require an environmental permit for its temporary storage and subsequent treatment and disposal.

A further environmental permit will be needed if wells pass through groundwater; an abstraction licence will be required if it is abstracted directly from surface water or groundwater for use in the hydraulic fracturing process. All of these permits take time to obtain and create additional costs for developers. However, in England the Environment Agency is developing plans to combine the different permit applications into a single application form.

The question remains as to whether the UK's shale gas reserves are sufficient to provide the answer to the UK's energy problems. The British Geological Survey (BGS) in association with DECC recently completed an estimate of the resource (gas-in-place) of shale gas in parts of central Britain.

With the lower limit of its estimated range being 822 trillion cubic feet (tcf), and the upper limit 2281 tcf,

experts is that even if the industry takes off, to what extent will UK shale gas production have a favourable impact on gas prices? Since the UK is linked to European markets by pipelines and to the Middle East through LNG supply, there is doubt around how likely UK shale gas production will materially reduce wholesale gas prices in the same way as in the US, which was, until relatively recently, a largely domestic market with limited export capability. However, given the overall rise in gas demand across Europe, this should not in itself be a deterrent to the development of the UK's shale gas resources.

With the strict regulatory, geological and economic considerations for shale gas exploration and production, developing the UK's shale gas resources is not going to be a straightforward or quick process, in spite of the government's efforts to try to streamline procedures and remove barriers. Although the government is keen to see the shale gas industry flourish in the UK, it remains to be seen whether it can deliver on its goals, or whether the industry will suffer from regulatory uncertainty in the same way as the carbon capture and storage, nuclear and renewables industries.

Angus Evers is a partner in the Planning & Environment Group and Rinku Bhadoria is a partner in the Energy & Infrastructure Group at King & Wood Mallesons SJ Berwin.



Evers: planning permission is arguably the most significant approval – and potentially the most difficult to obtain



Bhadoria doubts UK shale gas production will materially reduce wholesale gas prices as they have in the US

Under a nuclear cloud?

Anti-nuclear sentiment post-Fukushima, a changing energy landscape and high capital cost continue to cloud the future of nuclear power, especially in Europe. Yet Japan's decision not to abandon nuclear and successes in China show that the industry still has a future.

Junior Isles

Just over three years after the earthquake and tsunami that led to the meltdown at the Fukushima Daiichi nuclear power plant in Japan, the global outlook on the future of the industry remains fractured.

Japan, with its heavy dependence on nuclear and no other resources to replace it, has since taken the decision to continue with nuclear. However, countries with other options are looking seriously at the logic of continuing with the technology.

The knock-on effects of the Fukushima disaster have resulted in a bleak future for nuclear in Europe in general, especially for new build. Countries such as Belgium, Germany, Italy, Spain and Switzerland, have abandoned long-term plans for nuclear. While some may undertake nuclear lifetime extension projects in order to manage their transition away from the technology, there will be no nuclear new build.

Michael Kruse, Partner at the global energy and utilities practice of international management consulting firm Arthur D. Little commented: "The issue in general in Europe is that due to the changes in the overall energy

justify due to the greater volatility in energy prices and the impact of renewables, which is lowering energy costs in Europe."

Yet the picture is not homogeneous across Europe. Some countries still have a long-term commitment to nuclear, seeing it as a national requirement to keep it in the portfolio. Finland and Sweden remain positive, with plans for new projects. Eastern European countries such as the Czech Republic and Poland are also positive but may face issues, as highlighted in the recent decision to postpone bids for two new reactors at the Temelin site in the Czech Republic.

The nuclear industry does not have a proven track record for delivering projects on time and to budget

"It is always difficult to assess whether a project is deferred, still ongoing, or is just being communicated as ongoing from a media perspective. Some may publicly claim that a project is still being worked on but in reality it is not progressing any more."

"There are definitely plans in Eastern Europe. Poland still has 'plans' for nuclear new build. It has a project company EJ1. But my personal view is that new nuclear will not materialise in these countries in the mid-term. In the end they are part of the EU energy grid and have the same issues as other countries, and they have to finance new nuclear, said Kruse. "Ongoing projects, such as Hanhikivi 1 or Olkiluoto 4 in Finland, will continue but in other countries I am a bit more sceptical, despite the talk."

Arguably, financing is the biggest issue facing nuclear new build. Compared to other investments, the business case in the current climate is often not strong enough.

The escalating costs and time overruns at the two projects currently being built at Olkiluoto 3 (OL3) in Finland and Flamanville 3 in France have done little to help that case. OL3's construction costs were first estimated at €3.2 billion. Late in 2012, Areva estimated the overall cost would end up closer to €8.5 billion.

Such a high price tag has seen some operators look to Russia and potentially China to build projects and provide financing. In April Fennovoima announced that it had selected Rosatom for the proposed Hanhikivi 1 nuclear power plant. The originally proposed design was based on a plant featuring either Areva's EPR or Kerena design, or Toshiba's ABWR. The Russian supplier, however, not only offered proven technology but also financial support by taking a stake in Fennovoima.

There have also been discussions on

China's potential participation in the UK's planned nuclear programme. Although it is yet to be seen whether talks turn into projects, it is clear that the ability to financially support projects is making a strong business case for Russian and Chinese supplied technology.

Meanwhile, European governments continue to look for creative ways of financing the huge capital costs of projects – whether through market-based mechanisms or carbon taxes.

Certainly it is hard for a CEO to justify the business case for spending upwards of €6 billion in a market where future electricity prices are un-

most countries the licensing is completed before the start of plant construction (i.e. the GDA process in the UK), which favours a smooth construction phase."

The OL3 reactor is now 86 per cent complete and the project is nearing the commissioning phase. The company says that "significant progress" has already been made in 2014. The reactor containment tightness tests were successfully completed in February. On April 1st, it received the green light from TVO to begin testing the I&C system at the test bay in Erlangen, Germany and on April 11th, received approval from the Finnish Nuclear Safety Authority (STUK) of the overall I&C system plan for the reactor.

As a first-of-a-kind, Areva says "it knew there would be several lessons to be learnt" from the project.

"This is why Areva put in place a thorough return on experience feedback process to capture the lessons learnt and integrate them into its future and current EPR projects," said the company.

The return on experience gained from the ongoing projects has already been integrated into the engineering, procurement and construction phases of the EPR and is already benefitting the Taishan (TSN) 1 & 2 projects in China.

According to Areva more than 2000 lessons learned have been integrated throughout the different phases of the project, resulting in significant improvement in terms of time and associated costs. It says there is a 60 per cent reduction in engineering hours between OL3 and Taishan; shorter manufacturing time for large components through improved production processes; and increased reliability in the construction schedule through reduced procurement lead-times from suppliers, which have been shortened by an average of 65 per cent between OL3 and Taishan.

Areva argues that the Hinkley Point C EPR project to be built in the UK will fully benefit from the first two European projects as well as from the Taishan projects.

Kruse, however, is not entirely convinced that the success of keeping projects on time and to budget in China will automatically translate to projects elsewhere.

"It's difficult to judge. Labour costs in China are not the same as in Western Europe. With regards to catching up on schedules, in China it's easy to put another 500 people, for example, on a project if necessary. I'm not sure the experience of executing projects here can be transferred to other countries."

China, however, could provide an example of how other countries can build a successful nuclear industry.

"China has a clear strategy to develop domestic technology – it established competition between national companies to drive innovation. This was linked to technology transfer between western countries and China. It was also dedicated to setting up a strong national supply chain," argued Kruse.

However, it seems unlikely that other countries new to nuclear in Asia will be building up nuclear industries comparable to China and South Korea any time soon.

Kruse summed up: "There are ongoing new build projects in several countries. But few countries will have the financial strength and political commitment to sustain such a long-term venture. While the odd plant will be built, it will not be as the nuclear renaissance promised."



Kruse: the key is how to keep the same safety levels and be project-focused at the same time

The EPR construction site at Olkiluoto, Finland, October 2013. The project is now 86 per cent complete. © Areva



landscape, nuclear is increasingly difficult to handle in a utility's energy portfolio. The high capex of construction and the cost requirements for lifetime extension and maintenance to keep ageing plant up and running are becoming increasingly difficult to

certain and increasingly volatile, and there is competition from cheap coal or gas. Making such an investment without knowing that a government is committed to supporting nuclear is unlikely.

The business case also has to be justified for lifetime extensions and plant upgrades. "If a new equipment needs to be installed to increase safety margins at a cost of, say, €100 million, this would have to be compared, for example, to an investment in regulated offshore wind in Germany, which offers a margin of 8 or 10 per cent. Then the question is: is it still worth it?" said Kruse.

The difficulty in making investment decisions is compounded by poor forecasting on final price and time to build.

Indeed the nuclear industry is not one that has a proven track record for delivering projects on time and to budget – not just for new build but also for lifetime extension and upgrade projects and to some extent decommissioning.

"If you look at the Oskarshamn plant modernisation project in Sweden, there have been issues with cost overruns. There have also been cost overruns at lifetime extension projects in the US and other countries," said Kruse.

Whether things will ever change is a tricky question. "Nuclear operators would have to change their mind-set and attitude on how to do projects," said Kruse. "I believe there is a logical tension resulting from the requirements of operating nuclear power plants safely. The way of doing things for the safe operation of a plant is totally different to how a project should be executed according to time and cost efficiency. And this for good reason since nuclear safety is prime mandate. Nuclear operators have difficulty in switching mind-set. The key is how to keep the same safety levels and be project-focused at the same time. A systematic approach is needed that can combine both."

The problems at OL3 have been well publicised. In addition to being over budget, the project is already five years behind schedule.

The Areva-Siemens consortium building the plant noted that for several years, the project has been "impacted by disagreements" with the project's owner, TVO, "mostly regarding the application of the contract".

An Areva spokesperson commented: "In addition, the OL3 project is a first-of-a-kind. The licensing process is more complex and long-lasting than for series reactors already licensed. Also, it is important to note that in Finland licensing and construction are performed simultaneously, whereas in

Technology

Transmission capacity in real-time

Dynamic Line Rating (DLR) technology can boost the power capacity of overhead lines, while ensuring they operate within design limits. A demonstration project has just been completed in the US, which shows that real-time information from Nexans' DLR technology can reduce network congestion and bring added value to the Texas market.

Junior Isles

The technology enables system operators to make informed decisions on how hard they can drive overhead power lines



Dynamic Line Rating (DLR) – a technology aimed at increasing the capacity of overhead high voltage transmission, while ensuring transmission lines operate within prescribed design limits at all times – has been around for some time, yet there has been no real widespread application.

In March this year, Nexans announced the completion of a demonstration project in Texas, USA, that shows the technology's potential in a commercial environment. As part of the US Department of Energy (DOE) funded Smart Grid Development Programme (SGDP), the project showed that real-time information provided by Nexans' DLR technology can make an important contribution to increasing the power carrying capacity of existing overhead lines and reducing network congestion.

Essentially, Nexans' DLR technology provides real-time information on the average conductor temperature to enable system operators to make informed decisions on how hard they can drive their overhead power lines.

Commenting on the development, Sandy Aivaliotis, Senior Vice president Operations, Technology and Business Development at Nexans said: "You can think of it as a sensor, but unless it is integrated into the control room of the utility and into the market structure, it has very limited use. What we are talking about now is the 'intelligence' that can go on the cable – which has never happened before – to allow the utility or transmission system operator to optimise the utilisation of their existing or new assets."

Transmission lines are designed to operate safely at a maximum conductor temperature, typically 100°C. The amount of power that can be transmitted through the conductor is determined by weather conditions such as ambient temperature, solar radiation and, especially, wind.

Wind speed and direction can vary dramatically over the length of a line. A 1 m/s increase in wind speed from

a no wind condition can allow power throughput to be increased by 35 per cent, for a wind blowing at a 45° angle. If the wind angle is 90°, capacity can be increased by as much as 44 per cent.

A major challenge facing grid owners is how to accurately measure conductor temperature in real-time along the entire length of the line, taking into account the cooling effect of wind. Without instrumentation to monitor the line, engineers must assign a static rating based on the most unfavourable conditions.

Aivaliotis explained the problem with this approach. "Most of the heat in a conductor is transmitted radially, not axially. So if you look at static ratings i.e. the ratings that grids are based on today, the key elements that control the capacity of a conductor

is a robust solution because it is an analogue measurement integrated along the line. The analytics that we do is used to make the wire speak."

A simple load cell is used to measure tension, but "to bridge the gap" between tension and temperature Nexans uses a process called 'line calibration'.

"It's an empirical way of establishing the gap between theory and practice – it's a state change equation; we model the entire line. Weather stations are point measurements and cannot be counted on to calculate the average conductor temperature along the length of the conductor," said Aivaliotis.

The challenge to making this new information useful, however, is communication and integration with the operator's screen. Giving the operator

"On the most congested lines for Oncor, the payback is a matter of weeks"

are assumed."

The famous blackout in the US in 2003 was a classic example of the problem. Static ratings were based on a pre-determined wind speed for the entire network. Network operators were unable to see that lines were overheating due to a lack of wind on a particular day. This overheating caused lines to sag and touch trees, resulting in a phase-to-ground fault that cascaded through the network.

Dynamic line ratings measure all the effects of the conductor cooling so that the line can be operated at its safe design isotherm under all conditions. The Nexans DLR technology employs an algorithm that transforms real-time sensor data into a conductor temperature and calculates the maximum current capacity (the dynamic line rating), which maintains the overhead line sag within safe clearance limits.

The DLR is updated every 5-10 minutes, providing operators with much clearer visibility than both traditional static line ratings, which use pre-determined weather assumptions, and ambient-adjusted ratings, which takes into account the ambient air temperature.

The ability to accurately measure in real-time and, therefore, utilise the effects of conductor cooling allows operators to essentially release additional capacity already built into the grid.

Aivaliotis stressed: "The impact [of wind conditions on the transmission line] is not utilised on a wide scale on the grid today. We are missing the boat. We are building new lines which may not always be necessary."

Nexans began validating the technology when it acquired The Valley Group in 2007. It instrumented two spans of lines, each 183 m (600 ft) long, at an outdoor facility at Oak Ridge National Laboratories, a Department of Energy laboratory in Tennessee, USA.

"We wanted to show how line temperature changes as a result of the elements which we believed were important," said Aivaliotis. "The variations over this 600 ft span were huge."

Nexans' DLR technology essentially uses algorithms to convert tension on the overhead wires into average conductor temperature outputs. "This

real-time network visibility, and thus the knowledge of when more power can be transmitted, provides practical benefits. For example, it can help reduce the need for wind curtailment.

Potentially disastrous network failure caused by adverse weather can also be avoided. "Because the technology measures tension, it can detect ice formation on the line. When the operator detects this, they can transmit more power through the line to melt it before it becomes too thick and only mechanical means can be used to break the ice," noted Aivaliotis.

Nexans is also looking at how its technology can be used in applications such as helping to provide more accurate capacity forecasting.

The practical and commercial benefits were demonstrated to great effect in the SGDP Oncor project, which began during the summer of 2010. For the core component of the SGDP, Oncor installed Nexans' DLR technology on eight 138 kV to 345 kV transmission circuits in central Texas.

Oncor is the sixth largest transmission and distribution utility in the US and the largest in Texas with approximately three million points of delivery in a service area covering north central, eastern and western parts of the state. The utility operates as a transmission service provider within the transmission region controlled by the Electric Reliability Council of Texas (ERCOT).

Within ERCOT there are numerous transmission paths that are at times considered to have Commercially Significant Constraint (CSC), i.e., there is insufficient transmission capacity along the given path to transmit power from the lowest cost generation sources to load demand locations.

The SGDP DLR deployment is the first application of DLR technology to feed transmission line real-time dynamic ratings directly into the system operator's State Estimator and load dispatch programme, which optimises the matching of generation with load demand on a secure, reliable and economic basis.

The integrated Dynamic Line Rating (iDLR) collects transmission line parameters at remote locations on the

lines, calculates the real-time line rating based on the equivalent conductor temperature, ambient temperature and influence of wind and solar radiation on the stringing section, transmits the data to the Transmission Energy Management System, validates its integrity and passes it on to Oncor and ERCOT respective system operations. The iDLR system is automatic and transparent to ERCOT System Operations, i.e., it operates in parallel with all other system status telemetry collected through Supervisory Control and Data Acquisition (SCADA) employed across the company.

The conclusions of the project were published in a report in mid-November 2013. It highlighted several significant achievements.

On 345 kV lines, DLR provided up to 14 per cent additional capacity above the Ambient Temperature-Adjusted Ratings and up to 12 per cent on 138 kV lines. The incremental capacity was available from 83.5 to 90.5 per cent of the time.

The project found that 5 per cent additional capacity could relieve congestion by up to 60 per cent on the target lines with DLR installed, while 10 per cent additional capacity would practically eliminate all congestion on the target lines.

Aivaliotis explained: "Congestion [charging] or locational marginal pricing is essentially the price difference between two nodes, which can become very expensive. For example, typical wholesale electricity price is \$30-50/MWh. In Texas, in July 2011, that price went to \$3000/MWh. But most of the time, this so-called congestion is artificial; it's not really there. It's only there because of the static line rating."

Market driven congestion on the Oncor transmission lines in 2011 and 2012 cost more than \$122 million and \$141 million, respectively.

The economic impacts of being able to send more power down existing lines can be huge. According to Nexans, a system can be installed for 3-4 per cent of the cost of reconducting or building a new line. This, it says, means the return on investment could be hours to a few weeks or, in a worst-case scenario, months. A study for Kansas City Power & Light on a single line predicted a three-month payback.

"On the most congested lines for Oncor, the payback is a matter of weeks," said Aivaliotis.

Oncor also noted that by providing additional capacity on transmission lines where a full upgrade cannot yet be justified, DLR can be utilised in the planning process to enable a "least regrets" capital strategy. This is especially relevant where generation sources are changing more than ever. DLR provides the flexibility to accommodate this generation change while helping utilities optimise capital expenditure.

Jim Greer, Oncor Chief Operating Officer concluded: "Our investment programme is not about just adding more infrastructure. We want to be able to use our existing assets more efficiently and effectively because that's a more economical use of our investment dollars. DLR clearly demonstrated that we could improve the efficiency of our existing assets in an economical manner."



Junior Isles

Pugilists, politicians and puppeteers

We may only remember the two combatants in any great fight but there are always three people in the ring. In the looming battle for Alstom between GE and Siemens, spectators have been made well aware that that third entity is the French government.

Last month both GE and Siemens squared-up behind closed doors to present their fight plans to a French parliamentary committee.

Christophe de Maistre, head of Siemens France, extolled the virtues of the German company's proposal to transfer its rail business to Alstom plus an unspecified sum of cash in return for Alstom's power turbine assets. He said this would create two "European champions of worldwide reach".

Alstom is already in talks with GE over a €12.35 billion (\$16.8 billion) all-cash offer for its power arm. GE's chief executive, Jeff Immelt, told the committee that Alstom's

CEO Patrick Kron, had approached GE because "he knows that long-term success in power requires greater scale and resources than Alstom had at its disposal".

Immelt says that a combined GE-Alstom energy business would have greater strength and variety of technologies, and be able to compete especially in emerging economies, which are expected to have strong growth in electricity demand.

From a pure power business perspective, a deal with GE seems a better fit.

Harald Thaler, Industry Director, Europe, for Energy & Power at Frost & Sullivan explained: "GE is very strong in the gas turbine market but has not been as strong in steam turbines. It would give GE access to emerging markets, which are still more focused on coal-fired generation.

"For new-build, GE could potentially benefit from Alstom's turnkey expertise but this would be a relatively

small advantage. It could also benefit from Alstom's strength in power plant services and rehabilitation where there are opportunities coming up in Central and Eastern Europe and emerging markets where there are aging coal plants."

Although taking over Alstom's steam turbines would not give GE as large a market share as Chinese manufacturers such as Shanghai Electric and Dongfang, it would enable it to leapfrog MHI and Toshiba to rival Siemens as the largest international steam turbine supplier.

This was supported by figures in an upcoming Frost & Sullivan report which shows that in 2013 Siemens had a 9.9 per cent share of the steam turbine market by megawatts, compared with 6.4 per cent for Alstom and 3.7 per cent for GE.

GE would, however, benefit less from gaining control of Alstom's gas turbines. Frost & Sullivan's figures revealed that Alstom's share of the market in 2013 was just 3.6 per cent compared with GE's 38.1 per cent and Siemens' 28 per cent.

"GE is already the leader with an offering across all size ranges and applications, including the oil and gas industry, which has grown substantially in recent years. Alstom's gas turbine technology is probably not that attractive to GE. Alstom has not developed its gas turbines to the same extent as some of the others," said Thaler.

The synergies with Siemens on the power plant side are less clear. Indeed Siemens' move was initially seen by some as perhaps more of a defensive strategy to prevent GE from gaining greater market dominance in the global gas and steam turbine market.

"This would be more about creating an even stronger European company in the power sector to better compete with GE as well as the other Asia players," noted Thaler.

But even if the synergies are not so strong, Siemens may have the edge in terms of political support. Although Alstom has backed GE's offer, the government has raised doubts. Arnaud Montebourg, France's industry minister, wrote to Immelt, saying: "As it stands, we unfortunately cannot support the proposals you have made."

The French government appears keener in creating European champions in power and in particular rail, which it hopes would still be an Alstom company. Indeed Siemens believes that its rail proposal could be the deal-clincher.

It is a complex situation and none of the deals will be straightforward. There could be competition concerns, although it is unlikely. The power business is global and dominance in one region would not necessarily be an issue. At worst, there may be a requirement to sell certain assets.

Regardless of any potential concerns from the European Competition Commission that may arise later, the French government will certainly insist on some parts of Alstom being sold off before any deal is struck.

As a technology of national importance, the government will be looking to keep Alstom's nuclear expertise in power islands for nuclear plants on French soil.

On hearing of GE's proposal, former industry minister Jean-Pierre

Chevènement wrote to the prime minister, Manuel Valls, warning that allowing GE to take over Alstom's power business would "deal a fatal blow" to France's nuclear energy sector.

Thaler commented: "Here a Siemens offer might be more attractive in terms of keeping it in Europe generally. But negotiations are still going on and we don't really know what is going on behind the curtains, so to speak."

It is clear that both companies are manoeuvring to placate the French government.

Under pressure from ministers, GE has extended the deadline until June 23 for Alstom to make a formal decision on its offer and enter into exclusive talks. GE has also offered concessions on issues of key concern to French officials, including employment and the nuclear business.

Other concessions include allowing Alstom, which will be left as a rail company, to buy or form a joint venture with GE's signalling business, and putting the offshore wind and hydroelectric power operations that would be bought by GE into a separate subsidiary that could be part-owned by French investors.

Immelt remains "confident" in the deal saying that GE has thought through the issues it faces.

"You have to trust us a little bit that we know what we are doing," he said at a recent conference. "We know how to work with governments, we have an impeccable reputation in France. We are extremely experienced on this."

Hopefully Immelt needs no reminding of his failed attempt to buy Areva's grid business in 2009. On that occasion hometown advantage saw the spoils of war go to Alstom and Schneider. Like nuclear, what will happen to Alstom's transmission asset is another area of uncertainty and no doubt a key government consideration.

On paper the GE proposal appears to be more attractive. Alstom shareholders have already expressed their satisfaction with GE's proposal as it gives them greater access to cash.

But French politics is more likely to decide the outcome of this heavyweight contest than shareholder preference. The increased support of Front National in the recent European elections shows there is a growing nationalistic view within France and there will therefore be greater pressure to keep French industry French – or European at least.

The government has already demonstrated its intention to keep as much of its industry in French hands as possible, issuing a decree blocking any foreign takeover of Alstom.

It would not be the first time that the government has played a hand in Alstom's fate. In 2004, it opted to bailout the company rather than let it fall into the hands of Siemens. This time there is no talk of a public bailout.

Political signals indicate that Siemens may be luckier this time around, although it is not certain whether Siemens will even table a formal offer. It gave itself until June 16 to make a counterbid but this could be extended in light of GE's extension.

Whether Siemens decides to take on this fight or not, or whether GE wins head-to-head or by default, one thing is certain – the French government will be pulling the strings.

