

# THE ENERGY INDUSTRY TIMES

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# Finland puts faith in Russian reactor



Ottavainen: electricity will cost no more than €50/MWh

The selection of Rosatom's VVER reactor for a new nuclear power plant in Finland will add weight to the company's hopes of breaking into the European nuclear market. **Junior Isles**

Finland's decision to opt for Russian technology for its recently announced nuclear power plant will go some way to making nuclear power more economically feasible and sends a warning signal to competing Western technologies.

In a deal announced just before Christmas, Finnish consortium Fennovoima signed a contract with Rosatom to build a new 1200 MW nuclear power plant, Hanhikivi I, in Pyhäjoki in northern Finland. Operation of the plant is planned to begin in 2024.

The reactor is intended to secure

cheap energy for the members of the consortium, including steel company Outokumpu, retailer Kesko and some 40 other Finnish industrial companies or utilities.

Fennovoima's selection of Rosatom's reactor could be of huge significance. The plant will use Russia's latest VVER pressurised water reactor design, the AES-2006, instead of Areva's EPR design. The EPR has been chosen for another Finnish project being constructed in Olkiluoto and also for the proposed Hinkley Point C plant in the UK.

Pekka Ottavainen, Chairman of Voimaosakeyhtiö, the cooperative of Finnish companies that own Fennovoima, told *Energy Post* in an interview: "We have of course closely followed what has been going on at Olkiluoto and this has influenced our decision. Everyone is worried about what is happening with the EPR. For us the Russian option was clearly the best. It was a very simple selection."

He noted that the reactor size suited Fennovoima better than the 1600 MW EPR and added that it also helped that the Russians are offering proven

technology.

Importantly, electricity from the plant is expected to have a substantially lower price than that from Hinkley C, where EDF is set to receive a guaranteed 'strike price' of £92.50 (€110) per MWh for a 35-year period, linked to inflation.

Ottavainen told *Energy Post* that the Hanhikivi plant will deliver electricity at "no more than €50 per MWh". He added: "If it goes higher than that, there will be no deal."

Continued on Page 2

## EU probe casts Hinkley Point C into doubt until summer

The deal signed between EDF Energy and the UK government has been put under the microscope of EU regulators, casting the project into doubt until at least the summer.

The European Commission last month launched an in-depth probe into Britain's planned flagship nuclear plant at Hinkley Point C in southwest England to assess whether the project breaks EU state-aid rules.

Joaquín Almunia, Vice-President of the European Commission and Commissioner responsible for competition, has doubts with regard to the compatibility of the UK financing mechanism for nuclear energy with EU state aid rules.

In its analysis, the Commission will examine whether the state aid for the project outweighs the distortion it provokes in the internal EU energy market.

Mark Johnston, Advisor at the European Centre for Policy Studies said in an interview with the EU policy broadcaster *viEUws*: "If the Commission were to allow the [UK] principles behind the case, it would effectively put the single market into reverse. As those principles were exploited by other governments in other countries, it would in effect be the beginning of the end of the single market."

EU regulators said they would focus their probe on whether the deal – which guarantees EDF a 'strike price' of £92.50 (\$150.45)/MWh (inflation-linked for 35 years) for electricity from the plant – constitutes a fair price. The set price is nearly double current UK wholesale prices and makes the UK the first European country to guarantee a price over such a long period in a nuclear project.

The EU is also looking into the UK government's £10 billion loan guarantee for the scheme.

The Commission warns the deal could trigger a "subsidy race" between member states. If the state aid is approved it could be the beginning of similar financing schemes in the UK and elsewhere in Europe. Other countries such as the Czech Republic, Hungary and Poland have expressed interest in the UK model.

The UK says Hinkley C is vital to ensure security of supply and to promote low-carbon energy. Giles Chichester, a British Conservative Party politician and Member of the European Parliament for South West England & Gibraltar, said: "Whatever the outcome, one way or another we need to build new nuclear power stations in the UK."

The commission said it would

launch a public consultation into the agreement that could take four to eight weeks. The UK government will then have a month to respond before entering into open-ended discussions with officials.

Almunia referred to the UK plans as "a complex measure of an unprecedented nature and scale," and said regulators need to investigate thoroughly its impact on the UK and the EU internal energy markets.

Under EU rules, state support can be granted as long as a project promotes economic development without unduly distorting competition, among other criteria.

The Commission said EDF will "ultimately... not be exposed to market risks" and that it would also receive a state guarantee covering debts it might accrue in the construction of the plant.



Continued from Page 1

The project's capital costs will also be significantly lower than Hinkley C. Ottavainen estimates the Finnish plant will cost up to €6 billion (\$8.2 billion) – the 3.2 GW Hinkley plant carries a price tag of £16 billion (€19 billion).

Concerns over costs have, however, overshadowed the project, especially given the weak finances of many of its Finnish members. In November, 15 of Fennovoima's 60 shareholders decided to give up their shares in the project and E.On left the project at the end of 2012 as part of its strategic review.

Question marks over investment mean this is not yet a done deal. Fennovoima is due to make its final investment decision at the end of next month (February), when shareholders are to confirm their participation in the project. At the same time Rosatom will take a 34 per cent share in Fennovoima thus filling the funding gap left by E.On.

The consortium is expecting the remaining shareholders to increase their stakes and said it may take on new members to secure the required capital.

Jan Vapaavuori, the Finnish minister of economic affairs, welcomed the announcement.

"In this economic situation, new foreign investments to Finland are very welcome," he said in a statement.



The plant may also still face a permitting challenge. Some lawmakers have called for a new permit vote for the reactor since original plans mentioned only France's Areva and Japan's Toshiba as possible suppliers, which have now been dropped in favour of Rosatom.

If the deal goes ahead, it will represent a major triumph for Rosatom in the European nuclear arena and lend weight to future bids. Although the company is currently constructing 28 nuclear power plants, 19 of which are outside Russia (mostly in Asia), this is the first definitive European order for Russia in decades.

Rosatom is currently offering the AES-2006 reactor for two new units planned for the Temelin nuclear power plant in the Czech Republic. It is also looking to be part of the UK's plans for a new generation of nuclear plants.

Rosatom first indicated its interest in the UK in spring 2012, when Germany's RWE and E.On withdrew from the Horizon Nuclear Power project for the construction of two nuclear power plants with a total capacity of up to 6 GW in Wylfa and Oldbury.

In September last year it signed a memorandum of understanding with the UK government to co-operate on civil power. It then teamed up with Finnish utility, Fortum and UK engineering company Rolls-Royce to jointly investigate the possibility of deploying Rosatom's VVER-type reactors in the UK.

Under the three-way company agreement, Fortum, Rosatom and Rolls-Royce will begin preparatory work with a view to getting the VVER reactor into the UK's Generic Design Assessment, which is the first step in a wider approval process for new nuclear reactors.



- EU consults on reducing renewable support
- Inquiry launched into German support scheme

Junior Isles

The European Commission recently published its proposals for a review of the existing guidelines on state aid for environment and energy and the General Block Exemption Regulation. The proposals, which are out for a two-month consultation, are looking at putting an end to differentiated support for renewable technologies.

The review of the Energy and Environment Guidelines is part of the Commission's on-going overall state aid review process. The guidelines focus in particular on renewable energy sources (RES) support schemes, but have also introduced capacity markets, energy infrastructure and carbon capture and storage (CCS) into their scope.

Eurelectric, the association representing Europe's utilities, expressed its support for the objectives of the review process.

"Sound state aid rules are the foundation of a cost-efficient move to a low-carbon economy. Public support in the field of energy has increased

tremendously since the current guidelines were adopted. The review is an opportunity to safeguard Europe's internal electricity market and thus to ensure a competitive reliable power supply," commented Eurelectric Secretary General Hans ten Berge.

On RES support, Eurelectric backs the Commission's intention to advance market integration of RES by increasing the exposure of supported generation to market dynamics, as well as introducing balancing responsibility. Eurelectric also believes that the guidelines should make a distinction between RES support for mature and immature technologies rather than simply taking the deployment rate of the technologies into account.

After 2020 Eurelectric says it wants to see an 'ETS plus' system in which the EU's emissions trading scheme (ETS) replaces all subsidies as a strong signal for decarbonisation, accompanied by a 'plus' of research and development support for immature technologies.

Before that, it stresses that RES support schemes have to be reformed,

avoiding retroactive change, which damages the investment climate.

Others argue, however, that if the reviews were adopted, it would effectively stop Member States from determining their own energy mix – a fundamental principle of EU energy policy.

"These guidelines, if adopted in their present form, endanger Member States' ability to meet their 2020 renewable energy targets cost effectively," commented Pierre Tardieu from the European Wind Energy Association (EWEA). "Moreover, following the destabilising regulatory changes for renewable energy in many countries, requiring further fundamental changes to support mechanisms, would cause major investor uncertainty."

The guidelines are expected to enter into force on 1 July 2014.

Separately, the European Commission announced an inquiry into the German renewable energy support mechanism that could result in companies being forced to pay back billions of euros. The Commission said it would examine whether the reduction granted

to energy-intensive companies on a surcharge for the financing of renewables in Germany was compatible with state aid rules.

"The reductions seem to give beneficiaries a selective advantage that is likely to distort competition within the EU internal market," said the Commission. "Current state aid guidelines do not foresee the possibility of such reductions."

The Commission said it would also investigate tax discrimination complaints, as Germany's energy policy offered support only for companies using domestic green energy and not imported renewable power.

German chancellor Angel Merkel vowed to fight the Commission. She warned Brussels that the inquiry would put at risk jobs and the competitiveness of Europe's largest economy.

"We will make it very clear to the [European] Commission [that] Germany wishes to maintain a strong industrial base. We will make it clear that Europe is not strengthened when jobs in Germany are threatened," she said.

## Dirty UK coal plants bite the dust

- Eggborough uncertain future
- Drax gets green light for biomass and CCS projects

The future of Eggborough, one of the UK's largest coal fired power stations has been thrown into doubt following its failure to receive an early subsidy for its £750 million coal-to-biomass conversion plan.

The 2000 MW plant in North Yorkshire, which provides 4 per cent of Britain's electricity, was due to start work on the biomass project on January 6.

The lack of government support means the plant will no longer supply electricity after 2015, Eggborough Power Ltd said in a statement.

The lack of funding means the plant's number two generating unit will no longer be operational from September 2014, removing 500 MW of capacity from Britain's electricity grid, the company said.

"Unfortunately, following the gov-

ernment's confirmation that this coal to biomass conversion project is not currently eligible for early support under the 'Final Investment Decision Enabling Process', Eggborough is not in a position to move forward," said the statement.

Eggborough Power Ltd's chief executive Neil O'Hara said: "Unless a viable solution is found with government, the most likely outcome now is that Eggborough will no longer be supplying electricity to the grid beyond 2015."

To boost investment in clean energy technology, the government is reforming its electricity market and will replace the existing Renewables Obligation support mechanism with the new Contracts-for-Difference (CfDs) scheme.

CfDs promise guaranteed payments

for electricity produced by low carbon technologies to enable long term investment decisions. Biomass conversion projects are set to receive £105/MWh from 2014 to 2019 under the mechanism.

To avoid any pause in low-carbon energy generation while the transition is taking place from 2014 to 2017, the government has ranked 10 renewables projects to get early CfDs in late 2014.

Last month the government announced that Drax's plan to convert two units of the 4000 MW Drax coal-fired power station to biomass was among the 10 projects selected.

Under a separate scheme, the White Rose carbon capture and storage (CCS) project, also based at the site has also been awarded funding for the FEED (front end engineering design) study.

Drax, together with Alstom and BOC-Linde plans to construct a new 426 MWe gross oxy-fuel power plant designed to capture approximately 2 million tonnes of CO<sub>2</sub> annually. White Rose CCS is currently the world-largest oxy demonstration project in development in the world.

The project also includes the development of a CO<sub>2</sub> transport and storage network – the Yorkshire Humber CCS Trunkline – which would have capacity for additional CCS projects in the area.

Energy and Climate Change Secretary Ed Davey said: "I'm proud that the UK is at the forefront of developing carbon capture and storage – which could be a game-changer in tackling climate change and provide a huge economic advantage not just to this region, but to the whole country."

## Massive pipeline deal promises EU energy security

The proposed Southern Energy Corridor moved closer to reality with the signing of a massive \$45 billion 2000-mile gas pipeline deal that will see gas from the Shah Deniz II field being piped to Italy, bringing greater energy security to Europe.

The deal, signed between the BP-led Shah Deniz Consortium and the Azerbaijani government, will see development of the Shah Deniz project in the

Caspian Sea and the construction of pipelines across Turkey and into Greece, Albania and Italy. It is estimated that initial production will be 16 billion cubic metres (bcm) per annum, increasing to 23 bcm by 2023. Gas will reach Turkey in 2018 and Europe one year later.

Witnessing the signing in Baku last month, William Hague, UK Foreign Secretary said: "The announcement of

the Shah Deniz II development is welcome news for Azerbaijan, for the UK and for Europe. This adds to Europe's energy security and competitiveness by opening up a new source of gas for southern Europe."

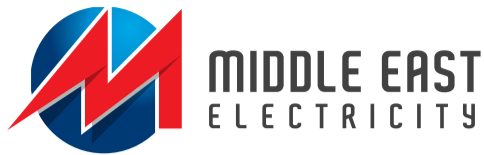
The new corridor will be based on three main pipelines: the Trans Adriatic Pipeline (TAP) across Greece, Albania and Italy; the South Caucasus Pipeline (SCP) through Azerbaijan

and Georgia; the Trans Anatolian Gas Pipeline (TANAP) from Georgia to Europe through Turkey.

"This decision to open the Southern Gas Corridor is a real breakthrough. Through its further enlargement, the corridor will have the potential to meet up to 20 per cent of the EU's gas needs in the long term," EU Energy Commissioner Günther Oettinger commented.



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# State renewable standards under scrutiny

Obama: pushing for renewable energy in spite of opposition



Industrial groups and state lawmakers are scrutinising the impact of renewable energy on energy prices.

Siân Crampsie

US President Barack Obama is continuing to push the case for renewable energy in spite of continued opposition from industrial groups and state lawmakers.

Obama last month ordered federal government agencies to triple the use of renewable energy sources by 2020, saying the government should lead by example.

He added that the plan to use renewable energy for 20 per cent of the federal government's electricity needs would not only reduce pollution but promote energy independence and boost the economy.

The plan is part of a continued drive

by Obama to combat climate change. However industrial energy users in some states warned that renewable energy is pushing up energy prices.

In New Mexico the approval of a major utility's renewable energy plan by the New Mexico Public Regulation Commission has given rise to objections from major energy users.

Meanwhile in Kansas, a group of lawmakers has called for the state to stop forcing utilities to buy wind power because of the impact it has had on ratepayers' bills.

Obama's latest initiative applies to all federal agencies and adds to a raft of climate change measures announced in mid-2013. The US Defense Department has already set a goal of sourcing

25 per cent of its energy needs from renewables by 2025.

Federal agencies have already reduced greenhouse gas emission by more than 15 per cent since 2009. Obama's new order says the government should use renewable sources for ten per cent of its electricity in 2015 and gradually increase that amount to 20 per cent by 2020.

The order also requires agencies to install energy meters and water meters where appropriate to monitor efficiency and to publicly disclose energy performance data through the Energy Department.

In New Mexico, the New Mexico Industrial Energy Consumers (NMIEC) organisation voiced its

opposition to a plan by Public Service Company of New Mexico (PNM) to buy 50,000 MWh of wind energy credits in 2014.

PNM's plan also includes the purchase of energy from a new wind farm in 2015 under a 20-year contract, and for the construction of a 23 MW photovoltaic facility.

NMIEC says that it is not opposed to renewable energy development but that it wants to minimise the impact of renewable energy on ratepayers' bills.

Utilities in New Mexico are required to comply with a Renewable Portfolio Standard (RPS) that obliges them to derive at least ten per cent of their electricity from clean sources now, 15 per

cent in 2015 and 20 per cent in 2020.

A similar RPS exists in Kansas and has been successful in driving the development of wind energy, with four out of six utilities in the state set to reach the 2020 target by 2016, according to the Kansas Corporation Commission.

This fact has led to some lawmakers in the state to call for a halt to any further requirements for renewable energy development because of the burden it has put on ratepayers.

Kansas' installed wind capacity has risen from 1,000 MW in 2009 to 2,700 MW in 2013, and there is more in the pipeline.

State lawmakers say that they will consider repealing the RPS in 2014 or eliminating the 20 per cent target.

## Brazil auctions transmission, generation contracts



Investment in Brazil's electricity sector is set to continue apace after a successful auction of concessions for new transmission lines and power plant projects.

A consortium led by EDP Energias do Brasil and Companhia Furnas Centrais Elétricas (Furnas) succeeded in its bid for the construction of the 700 MW Sao Manoel hydropower plant at a December auction, while bids for 16 smaller hydropower plants, 97 wind farms and five thermal power plants were also successful.

Three transmission concessions were also awarded at the auction.

The auction follows one held in

November in which contracts for 39 wind farms were awarded. Both auctions failed to award any solar power contracts because the price of solar energy in Brazil remains too high to compete with other forms of energy.

EDP and Furnas' Terra Nova consortium won the right to build and operate the Sao Manoel dam on the Teles Pires River, a tributary of the Amazon, by agreeing to sell energy for BRL83.49/MWh (\$35.76/MWh). Wind farms at the auction bid an average price of BRL119/MWh.

Solar energy in Brazil currently costs around BRL200/MWh.

The 16 smaller dams auctioned last

month will add 300 MW of capacity to Brazil's grid, while the five thermal power plants will add a further 161 MW.

The transmission auction was less successful, with three lots sold and a fourth lot failing to attract any bidders.

Two of the lots were won by a group comprising Brazilian companies Braxenergy and LT Bandeirante. The same group of companies won two bids at a previous transmission auction held last month.

The third lot was won by Taesa, the transmission unit of state-controlled utility Cia Energetica de Minas Gerais, or Cemig.

## Mexico passes historic energy bill

Private power companies will be able to participate in Mexico's electricity generation sector after the country passed a historic bill to reform the legal framework of its energy sector.

The energy bill became effective in mid-December after the Mexican Congress and the majority of the country's state legislatures approved the legislation to open up the power and oil sectors.

Both sectors have until now been dominated by state-run companies and the government hopes that the

reforms will attract private investment and underpin economic growth in Mexico.

Currently in Mexico's electricity sector private companies are allowed to generate electric power for self-generation purposes only.

Under the new rules, they will be able to generate and distribute electricity to the public alongside CFE, the state-run electricity company.

The new laws also call for the state regulatory authority's mandate to be strengthened. The government wants electricity prices to fall in order for the

economy to remain competitive. Even when subsidised, electricity rates in Mexico are 25 per cent higher than in the USA – Mexico's main trading partner.

The energy bill stopped short of privatisation of state companies but will also allow private participation in the oil and gas sector, a move seen as vital for unlocking the country's reserves.

Mexico is the world's tenth-largest crude oil producer but its oil output has fallen by a quarter since 2004 and it has also had to increase imports of petrol and natural gas.

## Consumers save in new energy plan

- Demand response at heart of conservation
- Darlington and Bruce refurbishment

Ontario's government has put energy conservation measures at the heart of its revised energy plan in a bid to cut the cost of energy for consumers.

The Canadian province's government has released details of its updated long term energy plan (LTEP) in which it says it will be able to offset most of the projected growth in electricity demand over the next 20 years through new conservation measures.

Its plans include the expansion of demand response (DR) programmes, incentivising energy efficiency projects and implementing energy efficiency standards.

Other measures in the plan include moving ahead with the refurbishment of the Darlington and Bruce nuclear power plants, starting in 2016, and a continued commitment to implementing renewable energy projects.

Ontario has been at the forefront of DR initiatives, which enable utilities

to curtail energy users' electricity demand at peak times, and the LTEP calls for DR to achieve a ten per cent reduction in peak demand by 2025. This is equivalent to 2,400 MW, according to Ontario's Ministry of Energy.

The new LTEP will help consumers save money, with residential consumers expecting to pay about C\$520 less over the next five years compared with the LTEP issued in 2010. Industrial consumers will save C\$3 million over the next five years and C\$11 million less to 2030.

Ontario has pledged to phase out coal-fired electricity generation by the end of 2014 and says that by 2025 about half of Ontario's installed generating capacity will come from renewable sources. The LTEP states that the Ontario government will request proposals for the supply of 600 MW of new wind energy over the next two years.



Ontario government: focused on conservation to cut costs





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# Thar coal will help adjust energy mix

Projects are under way that will use Thar coal deposits to help Pakistan diversify its generating mix, cut electricity prices and combat power shortages. **Syed Ali.**

A Memorandum of Understanding (MoU) signed in December looks set to pave the way for Pakistan to shift its energy mix to make use of abundant domestic coal.

Sindh Engro Coal Mining Company (SECMC) – a joint venture between Engro Powergen Limited and the government of Sindh – signed the MoU with leading business groups including Atlas, Liberty and Sapphire to set up the country's first Thar coal-based power plant.

The companies will invest \$800 million in the plant and are planning to attract new investments from national and international players.

Construction of the proposed 2x300 MW power plant will commence in the third quarter of 2014 and is expected to start generating power by the end of 2017. SECMC is a leaseholder of

Thar Block II and plans to construct a 3.5 million tons/year coal mine, to feed the mine-mouth power plant.

SECMC CEO Shamsuddin Shaikh said the MoU would dispel the impression that Thar coal was not a feasible source of energy. Thar is one of Pakistan's biggest unexploited energy reserves with over 175 billion tons of lignite – enough to meet the country's energy needs for next 100 years.

Last month the Asian Development Bank (ADB) approved a loan of \$900 million for a coal-fired generation unit that will also use Thar deposits. The plant will use an 80/20 blend of imported sub-bituminous coal and Thar lignite.

The 600 MW unit, the first in the country to use supercritical boiler technology, will be built at an existing oil fired power plant site in Jamshoro

in Sindh province, about 150 km east of the provincial capital, Karachi. The infrastructure developed at the site will also support the government's plan to have an additional 600 MW unit at the same site.

International tenders are expected to be invited by the end of February and it is anticipated the plant will be operational by December 2018.

Electricity generated from the plant will alleviate some of the power shortages and replace generation from small individual oil and diesel generators. It will generate electricity at a lower cost, saving about \$535 million per year on the fuel import bill compared with oil fired generation.

The new unit is part of a broader government effort to decrease the price of electricity. Coal-fired power plants provide a cost-effective medium-term

energy solution at a time when the country's natural gas reserves are dwindling.

Resolving the energy crisis is a priority for the country. "Acute power shortages of up to 20 hours a day have crippled economic growth and are contributing to unemployment and social unrest across the country," said Klaus Gerhauer, Director General of ADB's Central and West Asia Department. "There is an urgent need for more affordable and dependable sources of power and this unit will generate an additional 600 MW of electricity for the national energy mix."

The government is pursuing all options to resolve the crisis including large hydropower plants, renewable energy, energy efficiency, increasing domestic gas production, and importing electricity and natural gas.

Pakistan has substantial potential for large hydropower, which will be developed to meet long-term energy needs because of the longer construction period involved.

At the beginning of December, Minister of State for Water and Power Abid Sher Ali said the government is "making concrete efforts" towards completing the 969 MW Neelum-Jhelum project in Azad Jammu and Kashmir (AJK) on time.

Expressing his satisfaction at the pace of work during his visit to the site, Ali claimed the project would start generating power by the end of 2015.

At the end of November Prime Minister Nawaz Sharif broke ground on a 2x1100 MW nuclear power plant to be constructed in Karachi. He said the plant would take 72 months to complete.

## Guangdong carbon trading opens at €7

Carbon traded at about €7 per tonne late last month as Guangdong Province in south China commenced carbon emission trading. The first day of trading in the world's second largest emissions trading scheme (ETS) after Europe, saw about 120 000 tonnes of allowances change hands.

The transactions involving seven companies were worth Yuan 7.22 million (\$1.2 million), with prices between Yuan 60 and Yuan 61 per tonne (about €7 per tonne), according to the provincial carbon emission trading market.

According to analysts at *Reuters*, 28 companies bought three million tonnes of allowances for Yuan 60 per tonne in the first auction.

In Guangdong, the total carbon emission quota is 388 million tonnes. For 2013 and 2014, 97 per cent of the quota will be free and 3 per cent will be sold at auction.

More than 200 heavy emitting companies from power, cement, iron and steel sectors are required to participate

in Guangdong's pilot project, expanding a city scheme in the region's city of Shenzhen.

"The auction mechanism will increase business costs, but will save energy and reduce emissions," Xu Yunzhao of the Taiwan Cement Yingde Co., Ltd told *Xinhua* news agency.

In 2011, the National Development and Reform Commission, the country's top economic planning agency, approved pilot trading schemes in Beijing, Tianjin, Shanghai, Chongqing, Hubei, Shenzhen and Guangdong, and trading started in Beijing, Shanghai and Shenzhen earlier this year.

The pilot schemes are a landmark for China as it plans to establish a nationwide carbon trading market. The country has pledged to reduce carbon dioxide emissions by 40 to 45 per cent per unit of GDP by 2020, in comparison with 2005.

**Shenzhen: ETS expanded to rest of Guangdong**



## Vietnam power plans take shape

- Contract signed for Thai Binh 1, loans for Thai Binh 2
- ExxonMobil and PetroVietnam eye gas fired project

A number of thermal power projects are taking shape as Vietnam continues its capacity building programme to meet power demand that is expected to grow by more than 10 per cent per annum in the coming years.

On December 26, 2013, Electricity Vietnam (EVN) awarded Marubeni Corporation a \$1 billion contract to build the Thai Binh 1 Power Station in Thai Thuy district in the northern province of Thai Binh.

Construction of the 600 MW coal fired plant is scheduled to begin in the first quarter of 2014 and be completed by the end of 2017.

Two weeks earlier, Viet Nam Oil and Gas Group (PetroVietnam) signed a credit agreement worth \$795.25 million with the Korea Eximbank (KEX-IM) and several international banks to develop the Thai Binh 2 thermal power project. The loans will be used to purchase equipment for the plant, as well as to construct and install the equipment at the 1200 MW plant. The plant is being built under an engineering, procurement and supply (EPS) contract by a consortium of Toshiba Corp., Sojitz Corp. and Daelim Industrial Co.

Just before Christmas EVN awarded a contract to Doosan Corp., Mitsubishi Corp. and two Vietnamese firms to build the Vinh Tan Thermal Power Plant No. 4 in the province of Binh

Thuan. The plant's two 600 MW units are scheduled for completion in 2017 and 2018, respectively.

News of these contracts followed reports of plans by ExxonMobil and PetroVietnam to build a gas and power plant in central Vietnam to supply gas and power along the East Sea. ExxonMobil and PetroVietnam are reportedly looking for a 200 ha plot, half of which would be initially used to build a 1500 MW power plant. According to reports, the capacity of the plant will be raised to 4000-5000 MW and there will also be a gas processing facility.

Vietnam's power plans will take a significant step forward this year with the start of construction of the 2400 MW thermal power plant in Hai Hau District. In December, Nguyen Van Tuan chairman of Northern Nam Dinh province said the province would support the construction of the \$4.5 billion project.

The plant will be built in two phases. Phase 1, consisting of two turbines with a total capacity of 1200 MW, will be built in 2016-17. The second identical phase will be built in 2020-21.

At the start of December Vietnam's Ministry of Science and Technology and the United Kingdom's Foreign and Commonwealth Office inked a Memorandum of Understanding (MoU) on cooperation in using nuclear energy for peaceful purposes.

## Indonesia to pass new geothermal law

Indonesia is expected to pass a new law on the geothermal industry in April, paving the way for the country to develop its geothermal potential.

Asep Sugiharta, an official dealing with forest protection and biodiversity conservation at the Ministry of Forestry, said a proposed bill, which has been submitted to the House of Representatives Commission VII, which oversees energy affairs, is set

to become a landmark in the development of the energy business in the country.

Under current law, geothermal exploitation is described as a "mining activity", which means it is restricted from conservation areas.

This is a major hurdle in the development of geothermal energy as the majority of resources are located in conservation areas, which are strictly

supervised by the forestry ministry.

The new law is aimed at removing the association between geothermal and mining activities.

Despite having the largest potential for geothermal energy in the world, with an estimated 29 GW of electricity, only 5 per cent, or around 1340 MW, of Indonesia's geothermal resources are being exploited, according to a finding by the energy ministry.



## Europe News

# EMR gives policy certainty

The passing of new electricity market legislation in the UK will give investors greater certainty but will not remove all barriers to development.

| Siân Crampsie

The UK government is hoping that the enactment of the electricity market reform (EMR) bill and the publication of strike prices for renewable energy technologies will pave the way for investment in the country's energy sector.

The Energy Bill received Royal Assent last month and the government also revealed the level of fiscal support that various renewable energy technologies will receive in the new regulatory framework.

The so-called strike prices will give energy generators a guaranteed minimum price for electricity and the government has revealed that support for offshore wind energy will increase at the expense of onshore wind and solar power.

The government also said that onshore wind energy and solar projects might have to compete for subsidies in reverse auctions designed to drive down the cost of wind power. It believes that EMR will unlock up to £110 billion of private sector investment in the electricity sector by 2020, including £40 billion in renewable energy.

The strike price mechanism will replace the UK's current Renewable Obligation (RO) scheme and is encapsulated in the EMR's contracts for difference (CfD) scheme. The strike price for onshore wind has been set at £95/MWh, while for large-scale solar PV it is £120/MWh and offshore wind £155/MWh. Geothermal projects will

receive £145/MWh while wave and tidal stream projects will receive £305/MWh.

Support for most technologies falls slightly by 2017/18 to reflect the expected fall in costs of renewable energy. The strike prices for onshore wind and solar energy are lower than had been expected.

"Any reduction in support for onshore wind is unwelcome, and the government had promised that any drop would be based purely on economic evidence," said RenewableUK's Deputy Chief Executive Maf Smith. "Onshore wind is the most cost-effective form of renewable energy we have, so if we want to keep energy bills as low as possible, we need to ensure the level of support is right."

RenewableUK also said that plans to add an auction process to the onshore wind sector would add "more risk and could be severely detrimental".

The government says that it wants 10 GW of offshore wind energy capacity developed in UK waters by 2020, but analysts believe that the generous strike price may not be enough to bring all of the country's proposed schemes to fruition.

According to Bloomberg New Energy Finance, the CfD scheme could produce marginally better returns for investors when compared with the current RO scheme. However, CfDs also pose a number of new risks for developers that may erode those improved returns.

Sophia von Waldow, offshore wind analyst for Bloomberg New Energy Finance, said: "The government is anxious to convince investors and banks that it has built a cost-effective incentive system to drive the construction of offshore wind projects in the next few years, enabling the UK to maintain its position as the world's leading market for this technology."

"We are not convinced that it has yet done enough to minimise the complex web of risks that these projects, often in deep water and far from shore, will face. If so, the UK may fall short of that 10 GW figure for offshore wind capacity by 2020."

In November 2013 RWE announced that it had decided not to go ahead with the development of the £4 billion Atlantic Array offshore wind farm, and just three weeks later ScottishPower decided to drop the development of the Argyll Array project.

In both cases a number of technical and local physical barriers meant that development would have been too costly in current market conditions. Argyll Array was to have up to 300 wind turbines producing 1800 MW, while the Atlantic Array would have added 1200 MW to the grid.

The UK's offshore wind sector did receive a boost in December, however, when the government gave the go-ahead for the development of the Able Marine Energy Park, a port and assembly facility designed to support the offshore wind energy sector.

## Utilities bear brunt of Hungary rate cuts

Utilities in Hungary will have to bear the brunt of a further cut to household electricity and gas rates.

The country's government has announced plans to cut rates for the third time since the start of 2013. The cuts have proved popular with voters and have also helped to reduce inflation and boost consumer spending.

However utilities are already providing energy at cost to households as rates are about 20 per cent lower than

in early 2013. Major European energy companies such as E.ON, RWE, GDF Suez and EDF are active in supplying energy to consumers in Hungary.

Prime Minister Viktor Orban has not yet released information on the extent of the latest round of cuts, but *Reuters* reported in December that a decision would be made in January 2014, and that the cuts would help to bring Hungarian energy prices closer in step with wider European rates.

## Westinghouse in discussions for Kozloduy 7



Plans to build a new nuclear reactor in Bulgaria have moved forward with an agreement between Bulgarian Energy Holding EAD (BEH) and Japan's Toshiba to discuss investment opportunities.

BEH is keen for Toshiba to provide up to 30 per cent of the funding for a new reactor at the Kozloduy site in northern Bulgaria. Technology for the new reactor would be provided by Westinghouse, Toshiba's US subsidiary.

Westinghouse signed a memorandum in 2011 with the Bulgarian firm to cooperate in extending the life of the plant's Nos. 5 and 6 reactors and

decontaminating and decommissioning its Nos. 1 to 4 reactors, which had already halted operations.

Unit 7 would use Westinghouse's AP1000 reactor, a generation III+ reactor. Westinghouse is currently completing construction of four AP1000 plants in China and has started construction of another four in the US.

China Guangdong Nuclear Power Group (CNG) and EnergoNuclear from Romania have inked a cooperative letter of intent for jointly building the No.3 and No.4 generators of Cernavoda nuclear power plant. Commercial operation of the two units is expected in 2019 and 2020.

## Firms submit French offshore wind bids

Two major consortia of European energy firms have submitted bids for the construction of offshore wind farms in France.

The two groups – one comprising EDF Energies Nouvelles, wpd offshore and Alstom, and the other GDF Suez, EDP Renewables, Neoen Marine and Areva – have submitted bids for the Tréport and Ile d'Ieu/le de Noirmoutier projects, which together represent 1000 MW of new capacity.

The projects fall within the framework of the second call for tenders for French offshore wind projects

announced in March 2013. Both sites offer capacity of 480-500 MW to be brought into service between 2021 and 2023.

In a 2011 tender, the EDF Energies Nouvelles-wpd offshore consortium won three of four lots: Fécamp (498 MW), Courseulles-sur-Mer (450 MW) and Saint-Nazaire (480 MW). These projects are due to come into service from 2018.

In their bid, GDF Suez, EDP and Neoen have specified the use of Areva's new 8 MW offshore wind turbine.

## Roadmap opens door to shale gas development

The UK government wants to further assess the potential of the country's shale gas reserves because of the industry's potential to spur economic growth and reduce energy prices.

The government in December released a roadmap for the development of shale gas resources as well as an assessment of the environmental and economic costs and benefits of large-scale fracking.

The roadmap reveals that an area up to two-thirds the size of England could be opened up to shale gas development, while the strategic

assessment reveals that detrimental impacts could include an increase in traffic and emissions and put pressure on water resources.

Up to 8.64 trillion cubic feet (TCF) of shale gas could be produced per year in the UK, according to the government, bringing employment opportunities as well as income for local communities.

The government intends to incentivise fracking through a generous tax break scheme that is the most competitive in Europe.

"The announcement comes at a

critical time for the UK shale industry, which has recently faced increasing costs and occasional resistance from environmental lobbyists," said Greg Hammond, head of international oil & gas and partner at law firm Eversheds. "This measure will provide another even clearer signal that the shale industry is a key part of the government's overall energy strategy."

"It will also facilitate access to much needed funding for UK shale developers, which are now approaching a critical and costly period of testing and development."





# Ethiopia, Saudi, Algeria projects indicate solar on the rebound

■ PV industry rebounding ■ Saudi Arabia plans solar desalination

Siân Crampsie

Approvals of solar projects in Ethiopia, Saudi Arabia and Algeria during the last month confirm the rebound of the solar industry, which has been suffering over the last two years.

The Ethiopian government has given the go-ahead for the construction of three 100 MW solar photovoltaic (PV) farms in the east of the country.

Global Trade Development Consulting (GTDC) and its project partner Energy Ventures have been awarded a contract to build and operate the three plants, which will contribute to Ethiopia's ambitious integrated energy plan.

"This project represents a significant

advance in our Ethiopian energy initiative and is now part of our comprehensive Energy Plan," said Alemayehu Tegenu, Ethiopia's Minister of Water, Irrigation and Energy. "Given Ethiopia's large hydroelectric generation capacity and now wind and geothermal power generation coming on-line, large scale solar fits nicely into our energy portfolio and will provide significant power generation capacity much faster than the other renewable technologies."

"We spent months analysing the potential for a large-scale solar project in Ethiopia. We found that Ethiopia has some of the highest solar irradiance factors in Africa," said Dr. Yonnas Kefle CEO of GTDC. He added, "As with all

our projects, we intend to maximise the amount of local resources in the performance of this project."

Large-scale projects such as this are an indication that the global solar industry is on the rebound, according to IHS, which predicts that worldwide PV installations are set to rise by double digits in 2014. It says that solar manufacturing capital spending is recovering, module prices are stabilising and emerging markets are on the rise.

"After two years of a punishing downturn, the global solar industry is on the rebound," said Ash Sharma, senior research director for solar at IHS. "However, challenges remain, including changes in government incentives and policy, an on-going backlash to the

rapid rise of renewables and razor-thin margins throughout the solar value chain."

Despite multiple risks, IHS remains bullish about the development of the PV market in 2014 and firmly believes that global installations will be in the range of 40 to 45 GW, based on a bottom-up analysis of more than 100 countries.

In Saudi Arabia plans have been announced to build the world's largest solar-powered water desalination plant on the Arabian Gulf coast. The plant will have the capacity to produce 30 000 m<sup>3</sup> of water/day when completed.

Meanwhile in Algeria Yingli Solar together with Sinohydro Corp and Hydrochina Corp have been awarded

a contract to build 233 MW of PV projects in Algeria for a subsidiary of Sonelgaz.

Saudi Arabia and Algeria are typical of markets where high electricity demand and high solar irradiation will drive the uptake of solar PV in the next 12 months, says IHS.

According to IHS, Latin America is set to become a key PV market, with installations in the region reaching 1.4 GW in 2014, up from 300 MW in 2013. The majority of additions will take place in Chile and Mexico, countries without any conventional subsidies for PV.

IHS' analysis concludes that PV module prices will decline by more than 40 per cent in 2020 compared to 2013.

## Algeria to add over 8 GW

International companies are set to build over 8400 MW of new electricity generating capacity in Algeria after Sonelgaz awarded \$4 billion of contracts.

Samsung, a joint venture of Hyundai Engineering and Daewoo, South Korea's GS/Daelim and Spain's Duro Felguera have signed provisional contracts to build six combined cycle power plants, each with a capacity of around 1400 MW.

Samsung will build two plants – Mostaganem and Nâama, while Hyundai and Daewoo will build the Bellara and Oumache. GS/Daelim won the Kais and Djelfa plants, respectively.

The power blocks will be provided

by GE under a \$1.91 billion deal signed by Sonelgaz and the US equipment manufacturer in August 2013. GE will provide 24 gas turbines and 12 steam turbines for the plants.

Separately Sonelgaz has placed an order with MHI subsidiary PW Power Systems for 20 gas turbines worth \$500 million.

US-based PW Power Systems Inc. will deliver all the gas turbines to Sonelgaz in the first half of 2014 to meet growing power demand on the back of the African nation's solid economic growth, the company said.

The turbines, capable of generating 25 MW each, will be installed at four power plants in Algeria operated by Sonelgaz.

## Jordan's first wind farm reaches financial close

Jordan Wind Project Company (JWPC) has signed the financing agreement to begin construction of the Middle East's first utility-scale wind farm.

Located in Jordan, the 117 MW Tafila wind farm will increase the country's total power capacity by three per cent and contribute towards an increase in energy security.

The project will cost an estimated \$290 million.

JWPC is a co-development between InfraMed (50 per cent), Masdar (31 per cent) and EP Global Energy (19 per cent).

"JWPC's 117 MW Tafila Wind Farm is the first utility-scale renewable energy project in the Kingdom of Jordan and the region and is a major step toward getting Jordan on the renewable

energy map of the world," said Samer Judeh, chairman of JWPC.

Tafila will produce approximately 400 GWh of electricity annually for consumers in Jordan, where electricity demand is expected to grow by five per cent per annum until 2020.

"Jordan is one of the Middle East's most promising clean energy markets and this project is another milestone in the region's energy evolution," said Dr Sultan Al Jaber, CEO of Masdar, Abu Dhabi's renewable energy company.

He added: "Jordan is a prime example of where the cost of renewable energy is lower than conventional sources of power generation. This project is a natural step toward Jordan's energy and economic security."

## Coal demand buoyant, emissions rise

- Coal demand driving GHG increase
- EBRD ends coal finance

Coal demand is set to continue steadily rising over the next five years in spite of policies aimed at curbing its use and protecting the environment.

In its latest analysis of global coal demand, the International Energy Agency (IEA) says that although policies in China have helped to temper demand for the fuel, coal will meet more of the increase in global primary energy demand than either oil or gas.

"Like it or not, coal is here to stay for a long time to come," IEA Executive Director Maria van der Hoeven said. "Coal is abundant and geopolitically secure, and coal-fired plants are easily integrated into existing power systems. With advantages like these, it is easy to see why coal demand continues to grow."

"But it is equally important to emphasise that coal in its current form is simply unsustainable."

The IEA report came just two weeks after the Worldwatch Institute said that global greenhouse gas (GHG) emissions in 2012 reached their highest annual total to date, and would likely be higher in 2013.

The organisation called on the international community to take swift action to reverse the trend.

According to Worldwatch, CO<sub>2</sub> emissions from fossil fuel combustion and cement production reached 9.7 gigatons of carbon (GtC) in 2012, with a ±5 per cent uncertainty range, and may reach 9.9 GtC in 2013. The 2012 value is 58 per cent higher than emissions in 1990, the year often used as a benchmark for emissions trends.

Coal accounts for 43 per cent of the total emissions and oil 33 per cent. Coal also accounted for 54 per cent of the emissions increase in 2012, with notable increases in emissions from coal in countries such as Germany and Japan that have cut their use of nuclear energy.

Worldwatch says that China's emissions rose by 5.9 per cent in 2012, an increase that accounted for 71 per cent of that year's global increase.

However the IEA says that tough new policies in China have already had an impact on the global coal market. While China will account for nearly 60 per cent of new global demand over

the next five years, government efforts to encourage energy efficiency and diversify electricity generation will dent that growth, slowing the global increase in demand.

Despite its moderated demand forecast, the IEA does not project peak coal in China within the next five years, and the nation's consumption and production will remain comparable to that of the rest of the world combined.

Overall global coal demand will grow at an average rate of 2.3 per cent per year through 2018, said the IEA, compared with the actual growth rate of 3.4 per cent per year between 2007 and 2012.

Worldwatch notes that recent moves by the US government and the World Bank to limit international financing of new coal projects signals a desire to shift away from coal use.

Last month the European Bank for Reconstruction and Development (EBRD) followed suit and adopted a policy of only investing in coal-fired power plants in "rare or exceptional circumstances".



Maria van der Hoeven: "coal is here to stay"





## Companies News

# E.On mulls Italian sale

E.On might sell its business units in Italy and Spain as part of plans to focus its business on its home German market and achieve its asset sales goals.

German magazine *Der Spiegel* reported the move last month and said that E.On's new focus would be on Germany, the UK and Sweden.

E.On has not confirmed the report but says that it is continuously reviewing the strategic options for optimising its portfolio.

E.On owns over 6.2 GW of capacity in Italy and 4.5 GW in Spain. In December it announced that it had sold one of its German regional energy suppliers to a consortium of municipalities in the centre of the country.

According to reports in Italian newspapers last month, E.On appointed

Goldman Sachs to work on the sale of its Italian assets and the bank has valued them at €2-3 billion. One of E.On's motives for the sale could be the continued economic slump in Italy, which has led to a drop in energy demand with many power plants left idle.

Spain's economic performance is similarly poor. In Spain E.On operates both conventional and renewable energy plants and also distributes around 6.5 TWh of energy to over 690 000 customers.

Potential buyers for the assets include Edison, Gazprom and Eni. Both Enel and EDF say they are not interested.

E.On invested €11.5 billion in establishing footprints in Spain, France and Italy as part of its ambitions to become one of Europe's biggest energy

companies. It is not clear whether E.On would sell the assets as two large 'lots' or split them into smaller units.

E.On is under pressure to improve its financial position, which has weakened because of the economic recession and Germany's transition to renewable energy. It has implemented a plan to cut costs and sell €20 billion of assets.

In December E.On announced the sale of E.On Mitte for €610 million. Under the deal, E.On will sell a 73.3 per cent stake in E.On Mitte and receive cash proceeds of €610 million.

E.On said last year that it would sell stakes in all but four regional energy suppliers across its home market, resulting in a series of asset disposals to municipalities and publicly owned utilities.

## MAN strengthens in Africa

MAN Diesel & Turbo says that the purchase of South African firm ELCA Engineering will help to boost its global business.

The company's South African unit has purchased all of the shares in ELCA, a Johannesburg-based company specialising in the servicing and overhaul of compressors, pumps and turbines.

The acquisition will complement MAN's existing South African sales and service locations while enhancing its local footprint, the Austrian OEM said in a statement.

"This acquisition underlines our growth strategy in Africa and enables us to offer an even broader range of services in the sub-Saharan region," said Dr. René Umlauf, CEO of MAN Diesel & Turbo SE.

Johannesburg will be MAN Diesel & Turbo's hub for future global sales



## Fortum sells grid assets

Fortum is proceeding with the sale of low-yield assets, agreeing a deal with a group of investors to dispose of its electricity distribution grid in Finland.

The firm has agreed to sell the grid to Suomi Power Networks Oy, a consortium of Borealis Infrastructure, First State Investment and Finnish Pension funds Keva and Local Tapiola Pension for €2.55 billion. It is also considering the sale of its Swedish and Norwegian electricity distribution businesses.

The sale of the Finnish distribution business will allow Fortum to capitalise on the asset, which provides low but stable and predictable returns. The decision to sell follows an earlier strategic review of the business, said Fortum in a statement.

Fortum's electricity distribution business in Finland includes two jointly managed grid companies: Fortum Espoo Distribution Oy, with grids in the city of Espoo and surrounding communities and the city of Joensuu, as well as Fortum

Sähkönsiirto Oy, with several grid areas located mainly in southern and western Finland. The combined length of network held by the companies is 79 000 km delivering approximately 12.6 TWh of electricity to customers.

Fortum is planning to use the proceeds of the sale to bolster its financial position and for future growth opportunities in low carbon power generation. "Our ambition is to grow in accordance with our strategy in low-carbon power generation, energy-efficient combined heat and power (CHP) production and sales as well as in innovative customer offerings," said Fortum CEO Tapio Kuula.

He added: "Our electricity distribution business is in very good shape and deserves to be developed further as a core business from its own standpoint. We are pleased to have found a buyer, who has a deep understanding of the social importance of infrastructure assets and is committed to develop reliable networks and services for the customers."

# Westinghouse buys NuGen stake

The UK government wants to see the construction of at least 12 nuclear reactors by 2030

Westinghouse's move to buy a stake in NuGen is a further boost to the UK's nuclear programme.

Siân Crampsie

Westinghouse looks set to play a major role in the UK's nuclear energy revival after agreeing to purchase Iberdrola's 50 per cent stake in NuGen.

Iberdrola last month informed the Spanish markets that it had signed an agreement to transfer its share of NuGen – one of three new nuclear build firms in the UK – to Westinghouse. The sale price is £85 million.

The remaining half of NuGen is owned by GDF Suez. The company is proposing to build a new nuclear reactor at Moorside, adjacent to the Sellafield fuel recycling plant in northern England.

It is aiming to bring the plant on line by 2023.

The deal is a further boost to the UK's nuclear build plans, which had appeared to stall over uncertainty surrounding electricity market reform

proposals and agreements between investors and the government over the 'strike price' that nuclear plants would receive.

However the UK last month passed the electricity market reform bill, while both EDF and Hitachi have reached agreements with the government over the strike price, which gives generators a guaranteed price for the electricity they generate.

Toshiba – Westinghouse's parent company – was reportedly keen to gain a foothold in the UK's nuclear new build programme to keep in step with rival Hitachi.

Moorside is one of five proposed sites for nuclear new build in the UK, alongside EDF's Hinkley Point C and Sizewell C and Hitachi-owned Horizon's Wylfa Newydd and Oldbury B sites. If built, Moorside is likely to comprise up to three Westinghouse-designed AP1000 pressurised water reactors.

The Westinghouse AP1000 reactor is

in the final stages of generic design assessment (GDA) in the UK. To complete the process the AP1000 needs a customer and a specific site for certain engineering details.

The EPR has already completed the GDA process, receiving a Design Acceptance Confirmation and Statement of Design Acceptability in 2012, while a GDA was started for Hitachi-GE's ABWR in 2013.

The UK government wants to see the construction of at least 12 nuclear reactors by 2030 to help replace the country's ageing generating infrastructure. It has agreed with EDF a strike price of £92.50/MWh for energy generated at the Hinkley Point C project.

Iberdrola originally owned 37.5 per cent of NuGen but increased its share to 50 per cent when SSE withdrew from the partnership in 2011. The Spanish firm said that the sale of the NuGen stake was part of plans to divest non-core assets.

## Blackstone buys Centrica's Texas plants

Centrica is selling three gas fired power plants in Texas, USA, in order to focus its business there on retail supply.

It has agreed a \$685 million deal to sell the three plants to private equity group Blackstone. The three plants have a combined capacity of nearly 1300 MW and were bought by Centrica subsidiary Direct Energy in 2004 and 2006.

As part of the deal, Direct Energy and Blackstone have agreed a three-year call option arrangement for a similar amount of capacity to ensure Direct Energy can service its customer demand.

"This transaction allows us to realise value from our gas-fired fleet, while ensuring stability of price and supply in the Texas power market through the call option arrangement," said Badar Khan, President and CEO of Direct Energy.

"Residential retail supply is key to our North American business, and with sufficient generation capacity in Texas, we can support our downstream business through contractual arrangements, rather than asset ownership."

Direct Energy currently has about 6 million customers across 14 US states and four Canadian provinces.



## 10 | Tenders, Bids & Contracts

### Americas

#### Alstom supplies Queiroz Galvão

Alstom has signed two contracts totaling about €400 million with Queiroz Galvão, one of the main infrastructure groups in Brazil, to deliver, erect and commission 136 ECO 122 wind turbines at two large wind farms – Caldeirão Grande I and II – located in the state of Piauí, northeastern Brazil.

The two wind farms will generate a combined 400 MW. The ECO 122 wind turbines will be produced at Alstom's manufacturing unit in Camaçari (Bahia State) and will be delivered between 2015 and 2017.

#### H-class heading for Patriot

Panda Power Funds has placed an order with Siemens for the supply of two integrated power islands equipped with H-class gas turbines for the Patriot combined cycle power plant in Pennsylvania, USA.

The order is the second placed by Panda Power Funds with Siemens for this technology following an order in 2013 for the Liberty power plant, and marks the 27th H-class gas turbine sold by Siemens.

Patriot will fire local shale gas and have a generating capacity of 829 MW. Siemens will supply two integrated power islands for the plant, each consisting of one SGT6-8000H gas turbine, one SST6-5000 steam turbine, one hydrogen-cooled SGen6-2000H generator, and one heat recovery steam generator, along with the complete electrical system and SPPA-T3000 instrumentation and control system.

Siemens will also provide maintenance and service for the main components associated with the gas turbine under a long-term service programme.

#### ABB to upgrade HVDC stations

ABB has won orders worth \$75 million from Canada's Hydro-Québec and National Grid of the USA to refurbish three high voltage direct current (HVDC) converter stations.

The multi-terminal HVDC link between Québec and New England was the world's first such link to be put into service between 1990 and 1992. ABB will now replace the 20-year-old control and protection systems with the newest modular advanced control systems (MACH) for HVDC equipment.

The link has a total transfer capacity of 2000 MW of power and spans a distance of 1500 km from the La Grande II hydroelectric generating complex near James Bay in eastern Canada, via Nicolet, a substation located on the south shore of the St Lawrence river, down to Sandy Pond, near Boston, Massachusetts in the US.

#### US awards big onshore wind contracts

Two large onshore wind contracts have been awarded in the US.

US energy company MidAmerican Energy has awarded Siemens an order for the supply of 448 wind turbines. With a total capacity of 1050 MW, this represents not only the largest order for onshore wind turbines for Siemens, but also the largest single order for onshore wind power awarded globally to date.

The wind turbines, each with a nominal rating of 2.3 MW and a rotor diameter of 108 m, are to be installed in five different projects in Iowa. Siemens will also be responsible for service and maintenance of the wind turbines.

Meanwhile, Vestas A/S received an

order for 175 wind turbines from Enel Green Power North America, Inc.

The turbines will provide 350 MW of electricity with an option by Enel to order a further 650 MW. The deal includes supply and commissioning of the turbines.

Vestas says it will begin deliveries in 2014 through 2015.

### Asia-Pacific

#### Siemens wins Australia service contract

CITIC Pacific Mining Management has awarded Siemens a long-term service and maintenance agreement for the 450 MW Sino Iron power station in Western Australia.

The service contract is Siemens' largest ever for one of its SGT-800 gas turbines. The ten-year contract includes preventative maintenance, remote monitoring, parts supply, and field service and will help to ensure predictable reliability and maintenance costs for the seven SGT-800 units operating at the Sino Iron power station, located at Cape Preston.

The power station provides the electricity needed to power the largest magnetite iron ore mining and processing operation in Australia.

#### BHEL orders Neyveli components

BHEL has awarded Alstom a contract worth close to €125 million to supply components and services for the 2 x 500 MW Neyveli New Thermal Power Project (NNTPP) located at Neyveli in the state of Tamil Nadu in India.

Under the scope of the contract, Alstom will co-operate with BHEL in conceptualising, designing, engineering and supplying two tower boilers, the complete lignite milling and firing equipment, and critical components.

The 1000 MW greenfield NNTPP, being developed by Neyveli Lignite Corporation Limited, will be the first lignite-fired 2 x 500 MW power plant in the country and major source of power to the southern states.

#### Siemens wins San Gabriel EPC

NatGas Power Corp has awarded Siemens an engineering, procurement and construction (EPC) contract for a 414 MW combined cycle power plant in the Philippines.

The San Gabriel power plant will be built in Batangas City and is the third turnkey power plant built by Siemens in the Philippines. Siemens will supply a SGT6-8000H gas turbine, a SST6-5000 steam turbine, a hydrogen-cooled SGen6-2000H generator, a Benson type heat recovery steam generator, the electrical engineering, as well as the SPPA-T3000 control system.

#### Ming Yang wins first order in India

China Ming Yang Wind Power Group Ltd. (MY) has won a 150 MW order in India after becoming the first Chinese turbine maker to receive approval to sell machines in Asia's second-biggest wind market.

The project for an undisclosed developer in Maharashtra state will use 1.5-MW turbines, according to Hiren Shah, chief executive officer of Ming Yang's local unit, Global Wind Power Ltd. The machine was approved for sale by the government-run Centre for Wind Energy Technology in October.

Global Wind, a venture between Ming Yang and billionaire Anil

Ambani's Reliance Capital Ltd., expects to get Indian approval to sell a

second 1.5 MW turbine around mid-2014.

#### Areva signs Chinese deals

Areva has signed a series of major agreements with China National Nuclear Corporation (CNNC) and China General Nuclear Power Corporation (CGN) for the development of a Franco-Chinese partnership in both civil nuclear and renewable energy.

In consortium with Siemens, it signed a contract to supply instrumentation and control systems for reactors Fuqing 5 and 6, two 1000 MWe pressurised-water reactors. China Nuclear Power Engineering, a subsidiary of CNNC, is scheduled to start construction in 2014 for reactor 5 and the following year for reactor 6.

Meanwhile Areva and CGN signed a partnership agreement in the renewable energy sector. The companies will identify commercial opportunities in offshore wind, biomass, concentrated solar power, and energy storage.

### Europe

#### Poland strengthens grid

ABB has won an order worth around \$37 million from PSE S.A., Poland's state-owned transmission system operator, to deliver 12 power transformers as part of an initiative to strengthen the national grid.

ABB is responsible for the design, supply, installation and commissioning of the transformers, which range in capacity from 275 to 500 MVA and weigh close to 360 metric tons each. They will be installed in 11 substations across the country.

Some of the substations are new installations while others are being upgraded. Deliveries are scheduled between 2014 and 2017.

#### French wind orders

Vestas and Suzlon Energy's subsidiary REpower Systems have recently won orders for wind projects in France.

Vestas received an order from JP Energie Environnement for the supply of 17 V112-3.0 MW wind turbines for the Moulin d'Emanville project in central France.

The contract includes delivery, installation and commissioning of the wind power plant, as well as a 15-year full-scope AOM 5000 service and maintenance agreement. Commissioning of the power plant is expected by the third quarter of 2014.

The project is JP Energie's first wind power plant with Vestas turbines as well as the largest V112-3.0 MW wind power plant in France.

Meanwhile, REpower has concluded two contracts with GDF-Suez for the supply of 20 wind turbines for two wind farm projects in France.

REpower will supply GDF-Suez with its MM92 and MM82 wind turbines and will also provide full maintenance services for at least five years. Project deliveries are scheduled for the spring and summer of 2014.

The turbines will equip the Somme Soude wind farm in the Champagne-Ardenne region and the Hangest wind farm in the Picardie region.

#### Isolux Corsán gains UK solar foothold

Spanish EPC contractor Isolux Corsán has gained a foothold in the UK solar photovoltaic market with three new contracts to build solar plants at Penare, Egmore and Parley.

It will also construct the 31.6 MWp Stradishall solar plant in Suffolk County. This project, which will commence operation in late 2013, will produce 30 200 MWh/year.

These projects are being executed in collaboration with the developer British Solar Renewables.

#### Horizon awards nuclear contract

Jacobs Engineering Group has been awarded a framework management contract by Horizon Nuclear Power to provide engineering support and related services for two new nuclear power generation plants the company is developing at Wylfa on the Isle of Anglesey and Oldbury in South Gloucestershire, United Kingdom.

Under the terms of the contract, Jacobs will work collaboratively with Horizon to provide development and planning, site investigation, engineering, environmental permitting and waste management, and project management support.

The contract will last three years.

#### First Solar selected for France

First Solar has announced that its advanced thin-film solar modules will power four solar energy plants in France with a combined capacity of 48 MW.

The projects – developed and owned by Photosol, a French renewable energy company – are being constructed in the country's Auvergne and Midi-Pyrenees regions. Engineering, procurement and construction (EPC) services for all four projects are being provided by Jayme da Costa Energie, a leading French engineering company and a Photosol partner since 2011.

### International

#### HHI wins \$1.4 billion Kuwait order

South Korea's Hyundai Heavy Industries (HHI) said its consortium with French firm Sidem has won a \$1.4 billion deal to build a power plant and a desalination facility in Kuwait.

Under the deal with Kuwait's energy authorities, Hyundai will build a gas-fired power plant worth \$970 million, while Sidem will construct a water desalination plant in a combined complex about 100 km south of Kuwait City.

Construction was due to start in December 2013 and be completed towards the end of 2016, Hyundai said in a statement.

The power plant will have a production capacity of 1500 MW while the desalination plant would produce up to 486 000 m<sup>3</sup> of water a day.

#### GE powers Kinangop wind farm

GE has won an order to supply wind turbines for the 61 MW Kinangop wind farm in Kenya.

Kinangop will be one of the largest wind power projects built to date in sub-Saharan Africa and will be powered by 38 GE 1.6 MW wind turbines. It is owned by Aeolus Kenya and will be built by Iberdrola Engineering.

GE also will provide operations and maintenance for the wind farm through a full-service agreement (FSA) with Kinangop Wind Park Limited for 10 years.

It will also train local technicians and provide technical advisory support for connecting the wind farm to the grid.

#### Trina wins 1 MW order

Trina Solar Ltd has secured an agreement to supply 1 MW of Trina Honey photovoltaic modules to Mustakbal Clean Tech and Phoenix Solar Pte Ltd for use in Jordan's largest and first large-scale solar power project.

The power project, owned by the Ma'an Development Company (MDC), will be built jointly by Phoenix Solar and Mustakbal. Trina will supply 4032 solar modules, shipping of which was due to start before the end of 2013.





## Oil

# Rising US crude production having major impact

- Production to grow annually by 0.8 million b/d through 2016
- Calls to lift ban on US crude exports

David Gregory

The US Energy Information Administration (EIA) said last month that advanced technologies for crude oil production is continuing to increase domestic supply and reshape the US energy economy.

"Growing domestic hydrocarbon production is reducing our net dependence on imported oil and benefiting the US economy," EIA Administrator Adam Sieminski said in a statement announcing the release on December 16 of the *Annual Energy Outlook 2014 (AEO2014)* Reference case. The full report is to be released next spring.

In the *AEO2014* Reference case, the EIA forecasts that US crude oil production will grow annually by 0.8 million b/d through 2016, when it will likely average a historically high production rate of 9.6 million b/d. The administration said US crude output would level off at this rate and

start to decline after 2020 and return to current production levels of 7.5 million b/d in 2040.

But some analysts believe that US crude production, through the continuing growth in shale oil output, will continue to rise for a longer period.

The *Wall Street Journal* recently quoted Ed Morse, the head of commodity research at Citigroup, as saying the EIA forecast is too low and that he expects production to continue to increase through 2020 due to rising production coming from the Gulf of Mexico.

The report said that as US production reaches 9.5 million b/d on 2016 the net import share of US petroleum and other liquids supply will fall to about 25 per cent. It said that with a decline in domestic crude production after 2019, the import share of total petroleum and other liquids supply will grow to 32 per cent in 2040, lower than the 2040 level of 37 per

cent forecast in last year's reference case.

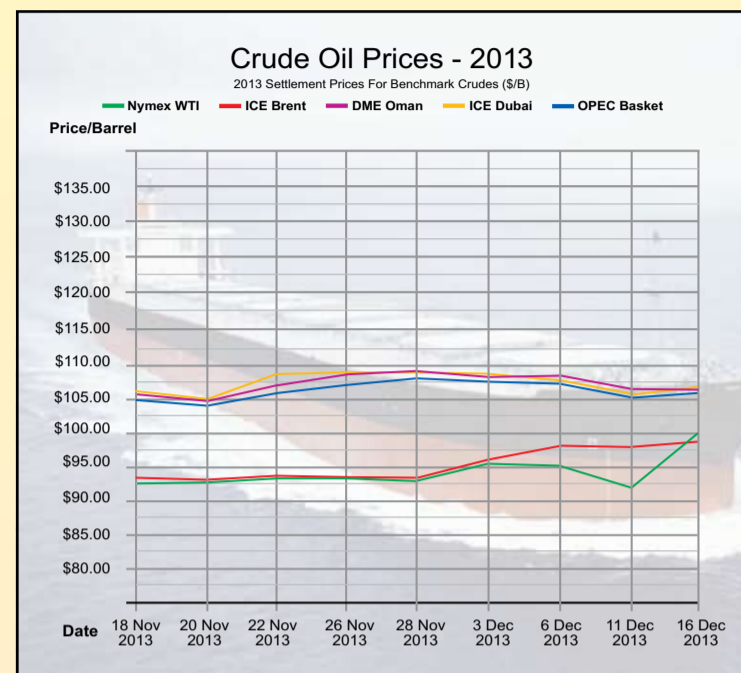
The *AEO2014* forecasts that the spot price of Brent crude will fall from \$112/b in 2012 (2012 dollars) to \$92/b in 2017, but then increase to \$141/b in 2040 due to growing demand that requires the development of more costly resources.

"World liquids consumption grows from 89 million b/d in 2012 to 117 million b/d in 2040, driven by the growing demand in China, India, Brazil and other developing economies," the EIA statement said.

Total US primary energy consumption grows by just 12 per cent between 2012 and 2040, according to the EIA forecast.

The fossil fuel share of total primary energy demand falls from 82 per cent to total US energy consumption in 2012 to 80 per cent in 2040 as consumption of petroleum-based liquid fuels falls.

The rise in US crude oil production



has prompted calls from the US energy industry that Washington lift a ban on US crude exports, imposed in 1973 after Opec halted crude sales to the US for its support of Israel during the war with Egypt and Syria. The Arab oil embargo set the scene for the creation by the US government of the Department of Energy and the Strategic Petroleum Reserve (SPR).

US companies must apply to the US Department of Commerce to obtain a license to export crude oil. Licenses are difficult to obtain and US crude that is exported, is usually sold to Canadian refineries. During 2013, the US exported around 95 000 b/d of crude. In 2012 exports averaged 67 000 b/d and in 2007 it was only around 23 000 b/d.

Critics of the export ban argue that the policy is a major factor for the wide differential between Brent crude and West Texas Intermediate (WTI).

Other analysts supporting US exports say that shipping US crude to foreign markets would benefit the US downstream sector.

Speaking at an energy conference in New York last month, US Secretary of Energy Ernest Moniz said now might be a good time for the US to consider lifting the ban on crude exports, but he said the decision would have to be made through the Department of Commerce, although he said the DOE would be willing to provide any technical analysis that might be needed.

Moniz said that restrictions on exports, like the SPR and Department of Energy, were established in an era of oil disruptions. He said there are many issues concerning energy that "deserve some new analysis and examination in the context of what is now an energy world that is no longer like the 1970s".

## Gas

# US natural gas to boost economic growth

Natural gas will overtake coal for power generation by 2040 as increasing gas production continues to boost natural gas intensive industries.

Mark Goetz

The December issue the US Energy Information Administration's *Short-Term Energy Outlook* said gas production in northeastern US rose from 2.1 billion cubic feet per day (bcfd) in 2008 to 12.3 bcfd in 2013. This trend, the EIA said, has reduced the cost and increased the supply of natural gas in the region.

"The additional supply has encouraged greater use of natural gas in the northeast, especially for power generation, and has also reduced net inflows of natural gas into the region from other regions such as the Gulf of Mexico, the Midwest, and eastern Canada," the *Outlook* said.

Natural gas marketed production amounted to 69.2 bcfd in 2012 and is expected to rise to 70.4 bcfd in 2013 and to 71.4 bcfd in 2014, the EIA said in the report. The price of natural

gas at the Henry Hub is expected to average \$3.69 per million Btu in 2013, compared to \$2.75/million Btu in 2012.

US natural gas production has risen significantly in recent years due to hydraulic fracturing.

The EIA released in mid-December its *Annual Energy Outlook 2014 (AEO2014)* reference case in which it forecast that natural gas production will grow steadily "with a 56 per cent increase between 2012 and 2040, when production reaches 37.6 trillion cubic feet (tcf).

Rising production and low prices are boosting natural gas intensive industries, the EIA said in a statement announcing the release of the *AEO2014* reference case. It said industrial shipments grow at a 3 per cent annual rate over the first ten years of the projection and then slow to 1.6 per cent annual growth over the

balance of the projection. Industrial shipments of bulk chemicals grow by 3.4 per cent annually from 2012 to 2025, but the competitive advantage of bulk chemicals diminishes in the long term, it said. Between 2012 and 2025, industrial natural gas consumption grows by 22 per cent, according to EIA data.

Natural gas will also overtake coal as the source for power generation due to the lower cost of gas, which will prove attractive to new generating capacity, the EIA said. "In some areas, natural gas-fired generation replaces power formerly supplied by coal and nuclear plants," it said. "In 2040, natural gas accounts for 35 per cent of total electricity generation, while coal accounts for 32 per cent."

One of the most significant impacts of higher natural gas production in the US is the prospect of larger exports, by both pipeline and through

the creation of an LNG export sector. According to the *AEO2014* reference case, US exports of LNG increase to 3.5 tcf before 2030 and remain at that level through 2040.

Pipeline exports to Mexico grow by 6 per cent annually, from 0.6 tcf in 2012 to 3.1 tcf in 2040, the report said, adding that pipeline exports to Canada rise by 1.2 per cent per year, from 1.0 tcf in 2012 to 1.4 tcf in 2040. Over the same period, gas imports from Canada decline by 30 per cent, from 3.0 tcf in 2012 to 2.1 tcf in 2040, as more US demand is met by local production.

The prospect of US LNG exports is seen as a plus for foreign markets that are looking for diversity of supply. Major producers like Qatar could see competition from the US, particularly in the Far East. Qatar has already seen its market for LNG in the US evaporate. Several LNG regasification

terminals in the US that would have received shipments from Qatar are now being converted to produce and export LNG.

European countries are looking to get US LNG exports included in a trans-Atlantic trade pact that is being negotiated. Europe sees US gas as a way of reducing its dependence on Russia. The US and the EU opened talks on the Transatlantic Trade and Investment Partnership (TTIP) in July and plan to conclude the treaty in 2014.

But while the US government has granted several gas companies licenses to export LNG, many representatives in Congress argue that exporting gas would increase its price in the US and stymie economic growth. Many US companies, however, are keen to export gas because of the higher prices foreign markets would pay.



## 12 | Energy Industry Data

## World: New Policies Scenario

	Electricity generation (TWh)						Shares (%)		CAAGR (%)
	1990	2011	2020	2025	2030	2035	2011	2035	2011-35
<b>Total generation</b>	<b>11 818</b>	<b>22 113</b>	<b>27 999</b>	<b>31 121</b>	<b>34 058</b>	<b>37 087</b>	<b>100</b>	<b>100</b>	<b>2.2</b>
Coal	4 426	9 139	10 618	11 236	11 797	12 312	41	33	1.2
Oil	1 332	1 062	801	676	591	556	5	1	-2.7
Gas	1 730	4 847	5 983	6 860	7 589	8 313	22	22	2.3
Nuclear	2 013	2 584	3 400	3 757	4 038	4 294	12	12	2.1
Hydro	2 144	3 490	4 555	5 003	5 428	5 827	16	16	2.2
Bioenergy	131	424	762	975	1 204	1 477	2	4	5.3
Wind	4	434	1 326	1 795	2 269	2 774	2	7	8.0
Geothermal	36	69	128	180	238	299	0	1	6.3
Solar PV	0	61	379	555	747	951	0	3	12.1
CSP	1	2	43	76	137	245	0	1	21.7
Marine	1	1	3	7	18	39	0	0	19.3

	Electrical capacity (GW)					Shares (%)		CAAGR (%)
	2011	2020	2025	2030	2035	2011	2035	2011-35
<b>Total capacity</b>	<b>5 456</b>	<b>7 308</b>	<b>8 121</b>	<b>8 922</b>	<b>9 760</b>	<b>100</b>	<b>100</b>	<b>2.5</b>
Coal	1 739	2 147	2 264	2 393	2 503	32	26	1.5
Oil	439	362	317	288	274	8	3	-1.9
Gas	1 414	1 854	2 058	2 247	2 462	26	25	2.3
Nuclear	391	471	512	545	578	7	6	1.6
Hydro	1 060	1 361	1 493	1 617	1 731	19	18	2.1
Bioenergy	93	154	190	226	266	2	3	4.5
Wind	238	612	797	960	1 130	4	12	6.7
Geothermal	11	19	27	35	43	0	0	5.9
Solar PV	69	312	437	564	690	1	7	10.1
CSP	2	14	23	40	70	0	1	16.7
Marine	1	1	3	6	14	0	0	14.7

	CO <sub>2</sub> emissions (Mt)						Shares (%)		CAAGR (%)
	1990	2011	2020	2025	2030	2035	2011	2035	2011-35
<b>Total CO<sub>2</sub></b>	<b>20 948</b>	<b>31 161</b>	<b>34 595</b>	<b>35 722</b>	<b>36 493</b>	<b>37 242</b>	<b>100</b>	<b>100</b>	<b>0.7</b>
Coal	8 323	13 761	15 280	15 580	15 653	15 651	44	42	0.5
Oil	8 819	11 079	11 948	12 137	12 283	12 459	36	33	0.5
Gas	3 806	6 322	7 367	8 005	8 557	9 133	20	25	1.5
<b>Power generation</b>	<b>7 468</b>	<b>12 954</b>	<b>13 985</b>	<b>14 457</b>	<b>14 792</b>	<b>15 180</b>	<b>100</b>	<b>100</b>	<b>0.7</b>
Coal	4 915	9 436	10 340	10 652	10 844	11 000	73	72	0.6
Oil	1 194	888	692	580	495	461	7	3	-2.7
Gas	1 359	2 630	2 952	3 225	3 452	3 719	20	24	1.5
<b>TFC</b>	<b>12 475</b>	<b>16 669</b>	<b>18 926</b>	<b>19 546</b>	<b>19 967</b>	<b>20 317</b>	<b>100</b>	<b>100</b>	<b>0.8</b>
Coal	3 269	4 027	4 613	4 602	4 490	4 341	24	21	0.3
Oil	7 070	9 559	10 605	10 915	11 157	11 380	57	56	0.7
Transport	4 396	6 760	7 675	8 006	8 307	8 598	41	42	1.0
Of which: Bunkers	619	1 112	1 241	1 318	1 399	1 485	7	7	1.2
Gas	2 136	3 083	3 708	4 030	4 321	4 595	18	23	1.7

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# M&A: 2013 and beyond

Many analysts hailed 2013 as an exceptional year for the energy industry overall but a closer look into the total value of deals carried out also suggests a return to a downward trend in business deals. **Torgny Gunnarsson**



**Gunnarsson: the M&A market will highlight where the growth and investment is likely to be**

On a global scale, many eyes are fixed on shifts in the energy markets, from country to country and region to region. This past year has seen a variety of movements in the market, which are likely to have wider consequences for the sector itself and beyond. From Turkey's aim to become a major energy hub to increased consumption in China and the ongoing back and forth discussions regarding the Kyoto agreement replacement, these are but a few of the major developments from the past 12 months.

They will help form the backdrop to another interesting year for the energy markets, to which past and current merger and acquisition (M&A) trends add the details: revealing where business and investor confidence lies and also indicating potential flows of capital between successful markets and geographical regions.

Since 2010, it has been widely acknowledged that M&A deals in general have been on a downward trend with fewer transactions taking place since the financial crash. However, the energy sector has defied this slump, nearly topping the M&A markets in terms of transactional value for the past four years. In particular, 2012 was a record year for the energy sector, with the €36.6 billion Glencore takeover of Xstrata – the biggest deal across all industries in the entire year. However, what of the year that has now drawn to a close?

Many analysts hailed 2013 as an exceptional year for the industry overall, although a quick glance shows that the energy sector was unable to match the heights of 2012. Indeed, a deeper look into the total

value of deals carried out in 2013 also suggests a return to a downward trend in business deals – a fact that reflects the massive impact the Glencore/Xstrata merger had on the global market the year previously.

Compared to previous years there has certainly been a decline in activity. Specifically, regions associated with classic fossil fuel production (with the exception of North America) and the conventional methods of their processing, are not faring well in an industry sector caught between the need to modernise and improve its environmental credentials while still providing millions with energy.

As a result, the emerging markets are where the growth is currently to be found. Turkey, Latin America, Asia-Pacific and Africa are all areas experiencing a surge in deals and takeovers in the sector. As expected, Chinese companies in particular are forging ahead in this respect as the country seeks to feed an ever growing demand for energy. These markets may not have experienced the highs of runaway successes witnessed before the recession in western economies, nevertheless there were a number of healthy transactions.

These included OGX's sale of a 40 per cent stake in two offshore blocks in the Tubarão Martelo field to Malaysia-based Petronas, and China Resource Power Holdings' merger with China Resources Gas Group – both of which involved significant sums. Looking further ahead, it has even been recently predicted by the International Energy Agency (IEA) that India's energy demand is set to outstrip that of China in the coming decades. Investment and business deals seeking to capitalise on this powerful economy are likely to follow.

In Latin America, news that Mexico published a new energy reform bill at the end of 2013, has offered the largest opening up of the country's energy sector in decades to private investors signalling the beginning of an energy investment boom. Although Brazil was under a heavy cloud towards the beginning of the year with rumours of electricity rationing, declining oil output and a reduction in ethanol production, the end of the year looked brighter as the country announced further plans to exploit its vast deepwater oil reserves. As the world's thirst for oil grows, reports from the IEA claim that Brazil is now set to play a major role in supplying oil across the globe. This is good news for those investing in the Brazilian market.

Turkey has also had a strong year having witnessed a spike in transactions from five deals up to 13 throughout the Fiscal Year. This has resulted in a more than fourfold increase in deal value, which has occurred after the country began to bring its energy policies in line with EU law and following on from the nation being granted the "EU Energy

Community with Observer" status. The most significant of these deals involved a joint venture between Energisa Power Generation and Sabanci Holding and E.On. The announcement that they were to buy electricity utility Toroslar Elektrik Dagitim for €1.3 billion came as Energisa Power Generation consolidated its position in the Turkish market ahead of a planned 2014 listing.

These significant deals reflect a buoyant international market, despite wariness elsewhere caused by unstable politics. In particular, public backlash associated with fracking and low consumer confidence in the otherwise widely-backed shale gas revolution are notable in Europe.

A general lack of confidence is another reason why the emerging markets are set to be the leaders in growth. Europe's debt crisis is something that still looms large in the minds of many heads of companies and investors, holding the M&A market back from finally shrugging off the shackles of the global financial crisis.

Energy firms have remained reluctant to follow through with deals when working in an unstable environment that is governed by political uncertainties and global, economic instabilities. It is because of this that arguably, despite a number of high profile deals taking place in 2013, the

producer, Australia is just one example of a country that is currently attempting to accelerate its clean energy transformation. Australia's Bureau of Resources and Energy Economics recently projected that by 2050 the share of renewable energy sources in the electricity generation mix will increase dramatically to 51 per cent, from ten per cent in 2010-11 under the Treasury's carbon price projections. It is clear that the Australian government's continued support of, and investment in, clean technologies indicates long-term investment opportunities in a country committed to green energy.

However, closer to home, as the UK government announced major cuts to green levies in its Autumn Statement, it still remains to be seen as to whether the renewables market will be able to continue its upward march. This expansion of renewables, cheaper coal and relatively low wholesale prices across 2013 is having a negative impact on gas plants in the UK. Since 2011, market conditions have been particularly challenging, especially for independent power producers who are now increasingly exploring refinancing options.

This environment is causing a stir amongst those investors who are able to wait for the market to pick up. Macquarie Group is one such example of a

## The increase in the value of renewables and gas deals has more than compensated for an otherwise slow year of power deals

overall energy M&A activity across global markets remained sluggish when compared with previous years.

The sentiment on shale gas brings us onto the second area of potential growth, and where the industry is likely to continue to develop into 2014 – that of alternative energy sources and fossil fuel processing methods. The majority of industry insiders and experts believe that this is where the growth is, and significantly where growth will be in 2014. A major UK deal was Cuadrilla's Resources' sale of a 25 per cent interest in the Bowland shale gas exploitation to Centrica. This success is mirrored in the USA, which has enjoyed a boom in shale gas activity – leading to a number of US-based firms having to reassess their global portfolios.

Alongside gas, the renewables area has also enjoyed a surge in activity. Many attribute this growth to global government support for clean and alternative power methods. The renewables deal flow is proving resilient in a challenging climate and with a backdrop of regulatory uncertainty. The increase in the value of renewables and gas deals has more than compensated for an otherwise slow year of power deals.

As the world's ninth largest energy

group of investors taking advantage of the situation following their closure of the purchase of the Sutton Bridge Power Station from EDF energy in March 2012. The acquisition is the second of its kind for Macquarie and it is clear that the business is taking a long term view of the profits to be gained in the power market.

A slowly growing sense of financial stability on the horizon is tempting many to unlock capital that has previously been held back during the turbulent years since 2008. The work Imprima has undertaken within the sector has revealed that there is a growing sense of global optimism in the energy sector. Those in the industry should, if they have not already, begin to keep an eye on developments in the M&A market as it will highlight where the growth, and where the investment, is likely to be. With this knowledge, business leaders will be well placed to take advantage and reap the benefits of an industry emerging from a recession relatively unscathed.

*Torgny Gunnarsson is CEO at Imprima, a data rooms and financial documents provider that helps financial organisations to complete global transactions.*



# Lowering the cost of wind

Operation and maintenance is a significant contributor to the cost of energy from wind farms, especially offshore. *TEI Times* speaks to Siemens' Ken Soerensen about how to bring those costs down.

**Soerensen: the industry as a whole still has to be more professional**



The cost of wind energy, especially offshore, is still an issue that the industry is working hard to address. Although capital costs account for a large portion of the cost of energy, operation and maintenance (O&M) is a significant and increasingly important component.

Siemens is one of the world's largest wind turbine manufacturers. With more than 2.5 GW installed, it is the leader in offshore wind and was notably the supplier to London Array, the world's largest offshore wind farm.

Ken Soerensen, Senior Vice President of Siemens Wind Power Service, says O&M costs can vary widely, with offshore coming in slightly higher than onshore. Depending on location and other project-specific factors, he estimates O&M can account for anywhere between 15 and 30 per cent of the lifecycle cost of wind energy.

He believes that the root cause of many of the challenges currently facing wind power is due to the fact that it is still a relatively young industry and is therefore still very much on a learning curve.

"Until a few years ago, turbines were designed with a lifetime of 20 years. Our 6.0 machine, which we launched about a year ago, has a design life of 25 years. But historical design lifetime has proven a little bit theoretical. In Germany for example, where there has been a quick ramp-up and where most of the high wind locations were 'occupied' decades back, operators are already replacing machines before the end of their design life with newer and bigger turbines," he noted.

Four areas constitute the main O&M lifecycle costs – the cost of remote

diagnostics; consumables (such as oil lubricants) and parts for minor repair (e.g. faulty sensors etc.); replacement of main components and the associated costs of the crane needed to change the component; and blue-collar labour or manpower, which is by far the biggest cost.

Looking at a turbine as a whole, Soerensen estimates that perhaps half of the issues experienced are related to electronics while the other half are

checks. It would also allow OEMs to make design changes to equipment based on diagnostic feedback.

"We look for opportunities to build more intelligence into the turbine. We would like to get as many sensors into the turbine as possible so that we can sit behind the computer desk and use remote diagnostics to solve the problem. This avoids us having to send people out to climb up the turbine," said Soerensen.

**Offshore is still too expensive and we need a comprehensive and well thought-out plan to bring down the cost of energy. Siemens has publicly committed to a target of €10 cents/kWh in 2020.**

related to mechanical problems.

In terms of major components, the gearbox is probably most likely to be in need of repair or replacement. As gearboxes have become more complex with more rotating parts over the years, Soerensen estimates that theoretically there could be up to a 50 per cent chance that a gearbox will need some sort of repair or replacement during the lifetime of a wind farm.

"This is one of the reasons we took the decision a few years ago to go to a direct drive turbine. Although we have not had too many issues with gearboxes, in direct drives there are just two rotating parts – a hub with three blades with a main bearing, and a generator. So mathematically, the long-term failure rate of a direct drive turbine will be better than a geared turbine where the gearbox contains many more rotating parts.

There are several things that can be done for the O&M part of the value chain to contribute to lowering the cost of energy.

A recent study by ExxonMobil claims the use of advanced synthetic gear oil in the main wind turbine gearbox can improve wind turbine availability and reduce operating costs. Over a 20-year lifecycle of a single wind turbine, increasing gearbox oil life from three to five years, will save approximately \$15 000 per turbine. In more meaningful terms, the operator of an 80 MW wind farm with forty 2 MW turbines would save \$600 000 over the lifecycle of the wind farm.

It also says that the main gearbox is expected to be replaced 2.2 times during the 20 years. If gearbox life can be extended one year through the use of synthetic gear oil, the replacement costs associated with the wind turbine life cycle will be reduced by \$77 000. Again, applying this saving to an 80 MW wind farm would result in savings of \$3.08 million over the life of the wind farm, says the study.

But Soerensen stresses that it is not just about cutting costs; "it's about intelligent costing," he says.

Siemens says it has more than 10 000 turbines that it monitors 24/7. Sensors on each turbine collect data such as vibrations from the actual turbine and send it, along with operational data such as wind speed, to a central database. Experts can analyse this data to determine when there might be an issue or problem and send a technician to check the turbine.

Monitoring and diagnostics is an area that Siemens believes both operators and manufacturers can use to greater effect. If diagnostics experts within OEMs become smarter at recognising patterns, it will be possible to predict potential problems and thus avoid sending out technicians to make

Unfortunately, operators are sometimes unwilling to pay the additional upfront cost of having a highly instrumented turbine. Such shortsighted thinking will not help the overall cost of energy in the long term.

Soerensen noted: "At times, it can be a bit challenging to convince project owners that it is worth a larger upfront investment for a higher quality product that has built-in electronics that could save money over the next 20 years. It comes back to the old proverb: sometimes it's expensive to be poor."

Soerensen also argues that while the onshore wind industry has come quite far, the industry as a whole still has to be more professional in the area of operational excellence.

This means following more disciplined procedures, analysing data and planning work more effectively. A better understanding of the data that comes from the turbine would, for example, enable suppliers to bundle jobs.

By analysing vibration data from turbines more carefully and recognising trends, it may be possible to identify the best window for service engineers to go to a site and change several components at once.

"This is especially important where you have to change main components that require a crane. Whether you have to mobilise a crane to change the gearbox at one turbine or three turbines, it roughly costs the same since the mobilisation of the crane represents the vast majority of the cost," explained Soerensen.

While the benefits of doing this offshore are obvious, smarter planning can also make a difference onshore. "For example, the number of days when it is not possible to do work due to bad weather is typically lower in the summer than the winter," said Soerensen.

Over the last two years, Siemens has done a significant amount of analysis on what it calls "LEAN at site". This relates to the order in which the work on the turbine is executed. The company says it has reduced the amount of hours spent inside the turbine but at the same time has learned that, like other companies, it needs to continue getting better at reducing the time engineers spend "around" the turbine e.g. at site waiting for the weather to improve.

"If we are better able to figure out when to do maintenance," said Soerensen, "we can make it coincide with when we have to stop the turbine to check the tightness of bolts, top-up lubricants and check tolerances during the annual scheduled maintenance."

Following on from this he also notes that the industry needs to move to condition-based maintenance as opposed to annual servicing. This makes sense as the number of operating hours within a year, and therefore the maintenance requirements, varies with the turbine's capacity factor. "A turbine that due to location with good wind conditions runs 50 per cent of the time needs to have 'the oil changed' more often than one that only runs 25 per cent of the time," noted Soerensen.

He added: "So it's a case of predicting things, planning better and doing things according to needs."

"If things can be run more as a factory than a wind power site – and this again comes back to the maturity of the industry – it will clearly bring down the cost of energy. In our effort to industrialise how to do things, we work hard to do the same whether it's in China, South Africa, Denmark, the UK or the US. This means, for example, that when we learn how to do something smarter in the UK, we can be quick to apply it to the same turbine in South Africa."

Bringing down lifecycle cost is an undertaking that manufacturers and plant owners must undertake together.

The wind sector is under pressure from politicians to bring down the cost of energy fast enough to show that they should continue subsidising the industry. As Soerensen put it: "We are racing against the clock."

"Offshore is still too expensive and we need a comprehensive and well thought-out plan to bring down the cost of energy. Siemens has publicly committed to a target of €10 cents/kWh in 2020. To do that we have had to do extensive work in understanding where the costs are coming from."

Soerensen acknowledges that while manufacturers have their work cut out, operators can also do more.

"In addition to taking a long-term perspective, I would like them to better recognise the value of our remote diagnostic capabilities. This is where our years of experience and industry know-how can be extremely valuable when deciding how to best perform O&M. At the same time, while Siemens is working to better industrialise O&M, some operators, who might, for example also run conventional fossil fuelled plants, believe they can do it themselves. But if they are going to take that approach, then they need to have the same focus as us in making sure it is run safely, reliably and efficiently, more like a factory and not some exotic new business."

"And finally, we, as an industry, should be better at working together. We are often unable to realise potential synergies between wind farms. Here the industry has to let go of its pride a little bit. If there are two sites next to each other, utilities need to be open to discussions with us to see if we can bundle services and help the two utilities save together."



## Technology

# The power of magnetism

With increasing gas prices impacting profit margins, whether they are supplying electricity or gas, utilities need to look at ways of getting more out of the fuel. A technology that is already popular in the industrial sector may provide some help, says **Junior Isles**

Factors such as weak electricity demand, high gas prices and competition from renewable generation, is seeing many of Europe's utilities come under financial pressure. For those selling gas to industrial customers, finding a way to help those customers reduce gas consumption through more efficient usage could in turn not only benefit the utility's bottom line but could also help it to keep those customers.

In October, Dutch energy supplier Nuon, a subsidiary of Swedish energy giant Vattenfall, signed a contract with UK-based cleantech company Maxsys Fuel Systems Ltd to become an exclusive supplier of Maxsys Fuel Systems, a piece of innovative equipment that cuts fuel costs and reduces CO<sub>2</sub>. Under the contract, Nuon has started selling and installing the equipment at its industrial customer sites in the Netherlands, with an option to extend to Germany and Sweden.

Speaking on the decision to partner with Maxsys, Jeroen Schut, Sales Manager at Nuon, commented: "Nuon has a commitment to maintain a reliable, sustainable and affordable supply of energy to its customer base, and to improve energy efficiency with customised, innovative solutions. It, therefore, makes perfect sense to partner with Maxsys to supply their fuel system to our customers so that they'll not only save costs, but also help in our vision for more sustainable energy usage."

The Maxsys Fuel System works by applying a calibrated magnetic field to the fuel prior to combustion, and can be applied to all types of combustion equipment. The technology can be integrated into existing combustion plants, and each unit is designed and built to the unique specifications of the individual plant.

According to Maxsys, experience has shown typical energy savings of at least 5 per cent, with a return on investment normally experienced within two years, and sometimes as quickly as three months.

The roots of the technology date back to the 1990s from work conducted by Professor John Donaldson



Installation of the system at the sites owned by companies such as Union Papertech has attracted the attention of energy utilities

at Brunel University on the effect of magnetism on water.

Early development of the product was aimed at tackling engine fouling due to sooting on ships. However, its potential application to the industrial sector did not begin until 2005 when a French private equity company, specialising in cleantech funding, decided to invest in the technology as a business that would help to reduce CO<sub>2</sub>. This enabled significant investment in research and development at both Aston University and Birmingham University in the UK.

Real commercialisation efforts, however, did not start until Paul Finnegan, Commercial Director and CEO at Maxsys came on board.

"They had invested in research but I was brought into the business in 2007 to help commercialise the technology. Their [R&D] work enabled us to best workout how to apply the system to any given piece of plant under the circumstances that the plant is working," said Finnegan. "I started targeting big energy users in the UK industrial sector, as well as some producers, offering systems to users, together with an analysis of the site."

For each project, Maxsys therefore adopted an approach of performing analysis using independent people as well as developing its own method of working with each customer, where it takes pre-data to analyse the performance of equipment beforehand and post-data for analysing after installation.

"We don't just sell the system, we do a full analysis of their plant each time," noted Finnegan. "It's something we do in every single job because buying our product is a capital expenditure, not a maintenance budget, and every capital expenditure item has to be justified. Whether it's a company like Johnson Matthey group, which has now bought a significant amount of systems, or any other customer, we will conduct an analysis because it is a capital expenditure. This allows for a quantifiable return on investment."

Explaining the system in basic terms, Finnegan said: "All fossil fuels contain impurities. In oil and gas these may be bits of the storage tanks, minerals or bits of after-product that is extracted from the ground. Following the refining process by the utility providers, these particles are reined to a size of 20 nanometres or smaller; they would never manifest themselves unless the burner was set up badly."

The Maxsys Fuel System, which is installed directly before a burner, applies a magnetic field to the fuel, the effect of which aggregates the

impurities contained within the fuel to form larger aggregates of about 200 nanometres. On leaving the system, the aggregates start to decay and separate back into its original constituents.

Finnegan noted: "This means it's quite important where the system is located. It has to be as close as possible to the burner. The aim is to have the impurities still aggregated by the time they reach the point of combustion so oxygen and hydrocarbon molecules react better and release their energy to produce a hotter and more radiant flame. This is the promotion of perfect combustion."

A boiler uses two types of energy – radiant energy and convective energy, i.e. heat from the hot gases, to heat the water tubes. If the energy is used at the radiant stage, it cannot be used at the convective stage. As the Maxsys system is designed to improve radiant energy, energy savings are greatest on a boiler where there are no systems in place to recapture or reuse convective energy.

According to Finnegan, the system can save up to 10 per cent in energy. He noted: "If you have invested in flue gas recirculation or economisers to utilise waste energy, our system would make this process less efficient since you would now have less convective energy to use. So the overall saving would not be as great, and would be around 5-6 per cent."

Installation of the system at the sites of a long list of well-known companies such as Dow Chemical, Union Papertech, Ford Motor Co and Arjo Wiggins, has now attracted the attention of energy utilities.

"When utility staff are out visiting some of these companies, which may be their customers and see these yellow boxes in front of the boiler, it creates an interest," commented Finnegan.

It may have been such an encounter that sparked Nuon's interest. Finnegan said: "They contacted us about a year ago and came to visit Ford's research centre." Months after that visit a contract was signed that will see Nuon sell Maxsys Fuel systems to its customers. Finnegan believes that the deal would allow Nuon to "lock-in" its industrial customers in terms of selling gas contracts. "By selling our system to their customers exclusively, gives them an advantage over their competitors and a USP in the marketplace."

He added: "It fits the bill for them in three ways. First, it helps with their commitment to reducing carbon emissions. Second, it is an easy to implement and relatively low-cost thing to do, and they can see that

there is already a customer base. And third, the exclusive arrangement with us would not only lock-out their competitors, it would also allow them to offer a utility supply fuel contract packaged with a Maxsys system. If any of Nuon's customer in Holland or Sweden want to buy our system, they now have to buy it from Nuon."

Nuon's industrial electricity supply company, Emmtec, uses the system to reduce fuel consumption at its own generating plant and also supplies the system to its industrial electricity customers.

In a power plant, the system can be installed in front of oil or gas fired boilers but cannot be used in conjunction with a gas turbine. "The reason for this," says Finnegan, "is because you need a system per burner, so you would have to put it on the fuel feed. But because gas turbines have a number of cans, and the effect of the system deteriorates with time and distance, the burner closest to the system would be more efficient than the one furthest away. This would result in vibrations."

It can, however, be used on the heat recovery. "We have an installation where there are four systems on the back of a GE gas turbine. Each of these weighs about three quarters of a tonne."

Finnegan notes, however, that this is about the limit in terms of size. "Even if we scale the system up to the size of the Empire State Building, you can't get the [magnetic] field any stronger."

The next technical development will therefore be the development of the system as part of a burner. This will be possible as a result of the acquisition of a boiler burner company by the Selas Heat Technology group, which owns Maxsys. "The plan for the overall group is to develop a range of burners with the system already installed so that you are buying it as original equipment."

Looking forward, Finnegan sees tie-ups with utilities like Nuon as the strategy for Europe. In the US, which is the company's biggest market, it will continue to sell directly to large industrial conglomerates.

"Our strategy [in Europe] is to have partners like Nuon. In 2014 we will start looking at extending our relationship with them and other partners into Germany and the whole of Sweden."

"At the moment, all of our talks are with continental Europe – northern Spain and southern France, Germany, Denmark, Sweden, the Benelux region and Italy – but no utilities in the UK. We are also in discussion with utilities in Canada and Mexico."

Finnegan says the system can save up to 10 per cent in energy







Junior Isles

# Russian brides may be more attractive

Over the years, several countries have attempted to divorce themselves from nuclear power but like all great romances the separation has been more short-lived than the half-life of Uranium-232.

All of Japan's nuclear plants are currently offline and are required to clear a set of safety requirements introduced in July before resuming operation. Because of the tougher regulations post-Fukushima, utilities could also be forced to shut down some reactors permanently.

Yet even as Tepco struggles to contain radioactive water leaks and begin the decommissioning process at the crippled Fukushima Daiichi nuclear power plant, a draft energy plan issued by a government panel in December states that Japan should continue to use nuclear power.

The draft Basic Energy Plan says nuclear energy should remain "an important and basic power source that supports the stability of Japan's energy supply and demand structure".

Prime Minister Shinzo Abe, who heads the Liberal Democratic Party that drove Japan's nuclear power policy prior to the nuclear crisis, has said his government will retract the nuclear phase-out goal of the previous government led by the Democratic Party

of Japan, now the main opposition party.

Despite the catastrophe, it appears that Japan is unwilling or unable to contemplate a future without nuclear. Indeed it seems the world cannot live without nuclear. And perhaps there is no reason why it should.

Incidents at nuclear power plants are rare but the few that have happened have grabbed global attention. Three Mile Island, Chernobyl and Fukushima were all serious incidents with long lasting consequences and after

ground. The nuclear industry seems to have developed a resilience born of patience. Vincent de Rivaz, head of EDF Energy (UK) cited the painstaking process of getting the go-ahead from the British government for the 3.2 GW Hinkley Point C project.

Speaking at the *Energy Choices* conference in London last month, he stressed: "We must remember what it has taken over the last 10 years to get to this point. In 2003, we saw what some called the nail in the coffin for nuclear."

The guaranteed price of power from Hinkley Point C is high. The recent deal between Rosatom and Fennovoima serves to illustrate just how high

each one, understandably, there has been a call to end nuclear power.

Yet safety is not the main threat to the plans of countries that want to keep their relationship with nuclear alive; it is price.

Each disaster has left the industry's relationship with politicians and the public in tatters but somehow they eventually manage to reach common

In 2003, a UK government Energy White Paper said that economics made nuclear an unattractive option for new, carbon-free generating capacity. It also said there were "important issues" of nuclear waste to be resolved. However, it did not rule out the possible use of nuclear at some point in the future as a means of helping to reach carbon targets.

At the conference de Rivaz and others noted that today, all of the country's three main political parties are now in support of a new generation of nuclear plants.

Political consensus may have changed but the economics still appear dubious. Through its Contracts for Difference support mechanism the UK government has managed to attract investors but its proposals may not wash with the European Commission. De Rivaz remains "confident" but acknowledges that there was a "further challenge in Brussels" over whether the support for Hinkley Point C was state-aid compatible.

In December the EU opened an investigation into Hinkley Point to determine whether the project breaks state-aid rules. On the day the UK government's Energy Bill became law, the European Commission expressed doubts over whether British ministers could justify state aid to nuclear, which it estimated could reach £17 billion.

The European Commission set out its concerns in a list of potential breaches of state aid regulations for the £16 billion (€19 billion) project's financing.

EU regulators said they would focus their probe on whether the deal – which guarantees EDF a price of £92.50 (\$150.45)/MWh, linked to inflation for 35 years – represents a fair price. The price is almost double current wholesale prices. The deal makes the UK the first EU member state to guarantee a price over such a long period. Analysts at Liberum Capital were recently reported as saying that the state guarantees on electricity prices offered to EDF in order to secure the deal could prove to be "economically insane".

In addition to the guaranteed energy price, the financial support for EDF and its Chinese partners also includes a £10 billion loan guarantee.

EU antitrust chief, Joaquín Almunia, said regulators need to thoroughly investigate its impact on the UK and

the EU internal energy markets.

British officials argue the project should not be seen as state aid but concede that it could be seen as permitted state aid. Under EU rules, state support can be granted as long as a project promotes economic development without unduly distorting competition, among other criteria.

Ed Davey, Secretary of State for Energy and Climate Change seemed unperturbed by the EC probe, saying it was standard for large investment projects and was always part of the process for Hinkley.

"We will use this period to demonstrate how the project meets state aid rules and provides good value for consumers while cutting carbon in the energy sector," he said.

If the EU determines that the deal for Hinkley Point C is not state aid compatible, it will be a severe blow to the British government. However, at the same time it could be just what is needed to drive down the cost of nuclear power.

Japan is learning that the nuclear divorce can be expensive, as will those countries that have decided to phase-out or ban new nuclear plants. But at the same time Britain is learning that the price of marriage can be high too.

In the event of the EU ruling against the deal, UK politicians may be forced to look at other options. The guaranteed price of power from Hinkley Point C is high. The recent deal between Rosatom and Fennovoima serves to illustrate just how high.

Under a contract signed just before Christmas, Rosatom will construct a 1200 MW Rosfield nuclear power plant in Pyhäjoki in northern Finland. It is the first time in the post-Soviet era that the Russian company will be building a new nuclear power plant in the EU.

Pekka Ottavainen, Chairman of Voimaosakeyhtiö, the cooperative of Finnish companies that own Fennovoima said the plant will cost roughly €6 billion and will deliver electricity at "no more than €50 per MWh".

Britain could do well to take some marriage guidance counselling from Ottavainen. Admittedly it is already courting Russia as it looks towards future nuclear projects. In September Rosatom signed a memorandum of understanding with British Energy Minister Michael Fallon, which will allow the company to familiarise itself with the UK market and forge links with British firms.

Rosatom also said it will partner with Finnish utility Fortum and UK engineering company Rolls-Royce to seek UK approval to sell its reactors in Britain. Under the three-way agreement, the companies will begin preparatory work with a view to getting the VVER reactor into the UK's Generic Design Assessment programme; this is the first step in a wider approval process for new nuclear reactors.

Earlier in 2013 a Rosatom senior executive said that it was unlikely to apply before 2015 for a license from British regulators, a process that takes about four years to complete.

However, if the Hinkley Point deal falls foul of the EC, or if the British government has second thoughts on the cost of power from the plant, the Russian-British courtship might flower into a full marriage sooner than any might have suspected.

Милая!  
Sweetheart!

